The Thesis Committee for Ahmed Mohammed Alshehri
Certifies that this is the approved version of the following thesis:

The Impact of Third Year Pharmacy Students Providing Medication Therapy Management in Community Pharmacies

APPROVED BY
SUPERVISING COMMITTEE:

Supervisor:

Jamie C. Barner

Carolyn M. Brown

Sharon Rush

The Impact of Third Year Pharmacy Students Providing Medication Therapy Management in Community Pharmacies

by

Ahmed Mohammed Alshehri, B.Pharmaceutical Sci.

Thesis

Presented to the Faculty of the Graduate School of

The University of Texas at Austin

in Partial Fulfillment

of the Requirements

for the Degree of

Master of Science in Pharmacy

The University of Texas at Austin

December 2012

Dedication

My entire thesis project is dedicated to my parents who raised me and supported me through my entire life. It is also dedicated to my lovely wife, Asma, my siblings, and my friends, who encouraged and motivated me to earn my Master's degree. I want to dedicate this project also to my uncle, Monees, who passed away nine months ago.

Acknowledgements

I want to thank God for his grace of health and ability to accomplish this thesis project. I want also to acknowledge my supervisor, Dr. Jamie Barner, for her advice and encouragement. I am very grateful for every moment she spent helping me completing my project. I also want to thank my Master's committee members, Professor Sharon Rush and Dr. Carolyn Brown. I want to appreciate Professor Sharon Rush for allowing me to utilize her class data as well as for her great advice. Also, I want to acknowledge Dr. Carolyn Brown for her contribution, comments and input on this project.

Also, I want to acknowledge my sweet wife, Asma, for her support and patience with me to pursue my Master's degree.

Abstract

The Impact of Third Year Pharmacy Students Providing Medication Therapy Management in Community Pharmacies

Ahmed Mohammed Alshehri, M.S. Phr.

The University of Texas at Austin, 2012

Supervisor: Jamie C. Barner

This retrospective study was conducted to examine the impact of third-year pharmacy students' provision of medication therapy management (MTM) on medication and health-related outcomes of patients in community pharmacies. The study objectives were as follows: 1) describe patients' socio-demographic and clinical characteristics; 2) describe the number and types of medication and health-related problems (MHRPs) identified by students, as well as students' MTM interventions and recommendations; 3) describe medical provider/patient MTM recommendation acceptance rates; and 4) determine which factors (i.e., baseline MHRPs, medical conditions, prescription medications, over-the-counter (OTC) medications and herbal supplements, number of medical prescribers, MTM interventions, and MTM recommendations) were related to the number of MHRPs resolved.

The study used data (MTM cases) from a required MTM course, taught at The University of Texas at Austin College of Pharmacy. The study included MTM cases

provided by third-year pharmacy students enrolled in the Fall 2011 semester. MTM cases that were complete, unduplicated, and had patients aged ≥ 18 years were included the study. Descriptive statistics were used to address the first three study objectives. Multivariate linear regression was used to determine which factors were related to the number of MHRPs resolved.

Out of the total number of MTM cases, 274 met the study inclusion criteria and served as the study's final sample. The patients' average age was 63.8 (±14.5), and the majority were female (60.4%) and Caucasian (53.2%). Almost one-third of the patients (30.7%) drank alcohol. The mean number of medical conditions and prescription medications was 6.0 (±2.7) and 9.0 (±4.0), respectively. Pharmacy students identified 1,370 MHRPs [935 medication-related problems (MRPs) and 435 health-related problems (HRPs)] and recommended 1,004 medication and health-related recommendations (MHRRs) [542 medication-related recommendations and 462 health-related recommendations]. Medical providers and/or patients accepted recommendations regarding drug discontinuation (34.8%) and OTC and herbal supplements (28.9%) at higher rates than other recommendations. Regarding the regression, the overall model was statistically significant, $F=76.88$, $df=7, 240$, $p<0.001$, and baseline MHRPs ($\beta=0.127$, $t=2.09$, $p=0.04$) and MTM recommendations ($\beta=0.715$, $t=11.37$, $p<0.0001$) were significantly related to MHRPs resolved.

In conclusion, pharmacy students had a positive impact on patients' medication and health-related outcomes through identifying MHRPs and providing MTM recommendations. The significant positive relationship between the number of MTM

recommendations and MHRPs resolved should encourage pharmacists and pharmacy students to be more eager to provide MTM recommendations, given the evidence that they will lead to improving patients' medication and health-related outcomes.

Table of Contents

List of Tables

List of Figures

CHAPTER ONE: INTRODUCTION AND LITERATURE REVIEW

1.1 INTRODUCTION

Medication therapy management (MTM) is one aspect of the Medicare Modernization Act of 2003 (MMA), which was enacted by the US Congress.[1] The Act required Medicare to not only pay for prescription medications, but also MTM.[1] MTM is "a distinct service or group of services that optimize therapeutic outcomes for individual patients. MTM is independent of, but can occur in conjunction with, the provision of a medication product."[2] The MMA stated the three goals of MTM as follows: (1) to educate patients regarding medications; (2) to improve patients' adherence to medication; and (3) to detect adverse drug reactions and patterns of incorrect prescription medication use.[3] Providing MTM services was not limited to specific providers; however, pharmacists were the only healthcare professionals named as a provider of MTM services. According to the Center of Medicare and Medicaid Services, 96 percent of Medicare Part D MTM programs use pharmacists to provide MTM services.[4]

Pharmacists-provided MTM services have improved the clinical and the economic outcomes of both patients and the health care system. From the clinical perspective, pharmacists identified and resolved many medication-related problems (MRPs)[5-15] and they educated patients regarding their medications and health in general.[16] In addition to having a clinical impact, pharmacists' provision of MTM services also had an economic impact by saving patients money (e.g., by substituting lower priced medications for higher priced ones) and avoiding additional health care expenditures (e.g., emergency room visits).[17,18] Pharmacists-provided MTM services indirectly saved patients and society the costs of missed or unproductive workdays.[17] Patients were also satisfied with the MTM services that were provided by pharmacists. In two different

studies, researchers found over periods of 2 and 10 years, respectively, that more than 95 percent of patients were satisfied with the MTM services that they received.[5,15]

On the other hand, pharmacists also faced barriers when providing MTM services. These barriers could be divided into difficulties unrelated to pharmacists and difficulties related to pharmacists. Pharmacy setting issues (e.g., inadequate documentation systems),[19] negative attitudes of other healthcare providers toward pharmacist-provided MTM,[20-22] and a low MTM reimbursement from Medicare Part D could be classified as difficulties unrelated to pharmacists.[21,23] In contrast, lack of specific MTM practice standards, lack of understanding MTM service components, and lack of MTM educational resources were difficulties related to pharmacists themselves.[24]

Several strategies are available to remedy these difficulties. Barriers unrelated to pharmacists could be addressed by: (1) using advanced documentation and billing systems,[16] (2) educating other healthcare providers about the impact of pharmacist-provided MTM services on patients' overall health,[25] and (3) adopting programs that compensate pharmacists for service provision.[26] MTM provision barriers related to pharmacists might be remedied by completing training programs, such as "Delivering Medication Therapy Management Services in the Community," which are designed to help pharmacists learn to provide MTM services effectively.[27] Furthermore, pharmacy students can learn and practice providing MTM services, so that they are prepared to provide them in the future.[28,29]

Several pharmacy colleges/schools of pharmacy have realized the importance of preparing their students to provide MTM. As a result, MTM courses have been proposed either as an entire course[30-32] or as a part of a course,[33-41] and they have been offered as a mandatory[34-36,38-40] or an elective course,[30,31,37,41,42] usually for third-[31,32,35,36,38,39,42] or fourth-year pharmacy

students. [37,41] Various strategies have been used to teach MTM, such as: didactic lectures,[31,36,38,39] case studies,[31,36,38,39] and MTM service provision to real or proxy patients.[30-32,36-38,41,43] Patients who participate in MTM services have been general community pharmacy patients[37] or specific types of patients (e.g., elderly, women, low-income, or uninsured patients).[30-34,42] MTM course outcomes have focused on increasing students' MTM knowledge and their abilities to provide MTM services, which include identifying and resolving patients' MRPs and educating patients regarding their medication and overall health.[32,35-39,41] MTM courses not only teach students how to provide MTM services to patients and increase their self-confidence in providing MTM, but they also improve patients' understanding of their disease state(s) and the medication(s) used to treat them.[34,36,37]

A review of the literature revealed that student-provided MTM studies described: MTM course structure, students' perceptions of the course and patient outcomes.[30-43] However, none of the studies examined the impact of a required MTM course on community pharmacy patients' medication and health related outcomes in which all students received lectures and provided MTM services. The University of Texas at Austin College of Pharmacy (UT-COP) developed an MTM course which is a mandatory for all third-year pharmacy students. In this course, students receive lectures about MTM and they provide MTM services at community pharmacies under the supervision of pharmacy preceptors.

This study will address the following objectives:

1. To describe patients' demographic characteristics (age, gender, race), social history (smoking, alcohol and caffeine consumption), and clinical characteristics (medical conditions, prescription medications, over-the-counter (OTC) medications and herbal supplements, and number of medical prescribers)

2. To describe the number and type of medication and health-related problems (MHRPs), MTM interventions, and MTM recommendations.
3. To describe medical provider/patient MTM recommendation acceptance rates.
4. To determine what factors (baseline MHRPs, medical conditions, prescription medications, OTC medications and herbal supplements, MTM interventions, number of medical prescribers, and MTM recommendations) are related to the number of MHRPs resolved (change in MHRPs from baseline to follow-up).

This study will contribute to the literature by describing student-pharmacist MTM interventions and showing their impact on patients in community pharmacies. In addition, the study may benefit other college/school of pharmacies (C/SOPs) that are considering adding an MTM course to their curricula.

1.2 LITERATURE REVIEW

1.2.1 Medication-Related Problems (MRPs)

Medications are a key factor in treating and preventing most diseases. However, medications are also associated with problems due to proper (e.g., adverse medication reaction (AMR)) and improper use and cost. The following discussion will illustrate how these issues are associated with improper use of medications.

1.2.1.1 *MRPs Due to Improper Use*

Incorrect use of medications, one aspect of medication-related problems (MRPs), can cause morbidity and mortality for many patients. An MRP is defined by the American Society of Health-System Pharmacists as "an event or circumstance involving medication therapy that actually or potentially interferes with an optimum outcome for a specific patient."[44] These problems can be divided into two types: intrinsic and extrinsic toxicity.[45] Intrinsic toxicity, which is considered synonymous with an adverse medication reaction (AMR),[45] occurs due to the interaction between a drug's pharmacological, pharmaceutical, and chemical properties and a patient's biosystem. An AMR is defined by the World Health Organization (WHO) as "any response to a drug which is noxious and unintended and which occurs at doses normally used in man for prophylaxis, diagnosis or therapy of disease, or for the modification of physiological function."[46] Consequently, AMRs are divided into two types of reactions, Type A and Type B.[45]

Type A reactions occur as a result of a medication's pharmacological as well as clinical effects.[45] Fortunately, this type of reaction can be avoided when patients receive the correct amount of the medication.[45] For example, acetaminophen can cause liver cirrhosis, which occurs due to the medication's pharmacological effect. As a result, this side effect can be avoided if patients do not take more than the maximum daily dose of acetaminophen, especially with long-

term use. Type B reactions occur in medications which have established therapeutic efficacy, but may also cause severe problems (e.g., anaphylactic shock), in a small number of patients.[45]

In addition to intrinsic toxicity, extrinsic toxicity occurs due to mishandling of medications by healthcare providers (e.g., physicians, pharmacists, nurses) and/or by patients, which leads to medication errors.[45] A medication error is defined as "any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the healthcare professional, patient, or consumer."[47] Although several classifications for medication errors exist in the literature, van den Bemt et al. divided them into four main classes: prescribing errors, transcription errors, dispensing errors, and administration errors.[45,48] Each of these types is described below.

Prescribing errors refer to the errors that may be caused by a healthcare provider in selecting, prescribing, and monitoring the medication. It might occur when a healthcare provider makes a mistake in selecting the medication or dose. Regarding prescribing, the literature indicates that there are 3 to 6 prescribing errors for every 100 prescriptions.[49] Moreover, the failure of a healthcare provider to monitor medications is considered a medication error. *Transcription errors* typically arise between prescribing and dispensing medications. This may occur when pharmacists or nurses misinterpret prescription details from a prescriber. *Dispensing errors* occur during the dispensing process and can include dispensing wrong medications, wrong doses, wrong instructions, or dispensing medications to wrong patients. Studies found the rate of dispensing error ranged from 0.08 percent – 4.0 percent of medications dispensed.[50-52] *Administration errors* may be caused by healthcare providers or patients. Similar to dispensing errors, healthcare providers may administer wrong medications, doses, or dosage forms, or use incorrect administration techniques. Bates et al. found 11 percent of adverse drug events

occurred due to administration error.[53] Patients may make administration errors when they take their medications at the wrong time or when they forget to take their medications. These patient errors can lead to medication non-adherence, which is defined as "the extent to which patients do not take medications as prescribed by their healthcare providers".[54]

1.2.1.2 *MRPs Due to Cost*

In addition to MRPs due to improper use, there are problems associated with the costs of treating MRPs, which may require physician visits, emergency department visits, or additional medications. Previous research has indicated that adverse medication events cause up to 12 percent of adult tertiary care emergency department visits.[55] Estimating the cost of treating MRPs is difficult due to variations in cost-sharing responsibilities. However, the health care system pays a substantial amount of money for treating MRPs. In 1995, Johnson et al. estimated that drug-related morbidity and mortality costs were $76.6 billion in the ambulatory care setting in the United States,[56] while in 2000, Ernst et al. estimated the cost at $177.4 billion.[57] In 2007, an Institute of Medicine report estimated that 1.5 million adverse medication reactions (AMRs) occur annually, leading to 44,000 to 98,000 deaths every year in hospitals, with an associated loss of productivity. Moreover, the report showed that the additional medical cost for treating MRPs in hospital settings was approximately $3.5 billion per year, not including productivity loss.[58] In conclusion, MRPs burden both health care systems and individual patients; thus, this issue needs to be addressed collaboratively with patients, healthcare providers, and health care systems.

In addition to the cost of MRPs, the cost of medications themselves is also a burden to both patients and health care systems. In 2007, the cost of diabetes alone was approximately $174 billion, with direct medical costs totaling $116 billion.[59] According to the U.S. census,

increases in medication costs outpaced increases in overall health care expenditures from 2004 to 2011.[60] This increase impacts patients, because many have to pay a co-insurance, which is dependent on the cost of the medication. Increasing medication costs, especially medications for chronic disease, compel patients (e.g., low-income patients) not to adhere to their medications, which worsens their health status. Research indicates that low-income uninsured women are seven times more likely to face a cost barrier to prescription drugs, compared with higher income women with insurance.[61] Appropriate medication management may be beneficial in reducing MRPs and enhancing patient outcomes. One specific method to address MRPs is medication therapy management (MTM), which is described below.

1.2.2 Medication Therapy Management (MTM)

In 2003, the Medicare Modernization Act (MMA) of 2003 required Medicare to not only reimburse the cost of prescription medications, but also the costs associated with managing these medications.[1] This legislation, enacted in 2006, established the concept of Medication Therapy Management (MTM), which was associated with establishing Medicare Part D.[2] Medicare Part D is a federal health insurance program that covers prescription medications of U.S. patients, who are: 1) age 65 or older; 2) under age 65 with certain disability; or 3) at any age with end stage renal failure.[62] The 2011 eligibility criteria for Medicare Part D MTM enrollment is as follows: patients must have multiple chronic diseases, take multiple Part D drugs, and be likely to exceed $3,000 in annual medication costs.[4]

The legislative language regarding MTM was purposefully broad to allow for competition among health plans.[3] To assist pharmacists with implementation of MTM, the American Pharmacists Association (APhA) and the National Association of Chain Drug Stores (NACDS) developed a framework for MTM consisting of five core components: (1) Medication

Therapy Review (MTR); (2) Personal Medication Record (PMR); (3) Medication Action Plan (MAP); (4) Intervention and Referral; and (5) Documentation and Follow-up.[63] Providing MTM was not assigned to specific medical providers; however, pharmacists were named as healthcare professionals qualified to provide the service. In 2011, the Center for Medicare and Medicaid Services (CMS) reported that more than 96 percent of Medicare Part D MTM programs used pharmacists to provide MTM services.[4] Following is a brief description of the five core MTM components.

In *Medication Therapy Review (MTR)*, the pharmacist reviews all patient medications, including: prescription medications, over-the-counter medications, herbal supplements, and immunizations. Also, this step requires the pharmacist to: (1) assess the patient's cultural issues, language barriers, education level, and communication ability; (2) interpret and monitor the patient's laboratory results; (3) identify the patient's MRPs; (4) develop a plan for resolving each MRP; and (5) contact other healthcare professionals to solve the MRPs.[63]

The next step is the creation of a *Personal Medication Record (PMR)*, which is usually created electronically either by a pharmacist alone or in collaboration with the patient. It includes, but is not necessarily limited to, the primary physician's name, the pharmacy and pharmacist's names, the patient's allergies, the patient's MRPs, and medication information (name, dose, indication, instructions for use, start date, and stop date).[63]

The pharmacist also creates a *Medication Action Plan (MAP)*, which depends on the patient's MRPs or recommendations. The MAP includes the patient's name, primary care physician, pharmacy and pharmacist's names, date of MAP creation, action steps for the patient, notes for the patient, and appointment information for follow-up with the pharmacist.[63] Importantly, this MAP includes only items that occur within a pharmacist's scope of practice or

that another medical provider has approved. Moreover, pharmacists should provide patients with a copy of the MAP and encourage them to share it with other healthcare providers.[63]

Next, *interventions and referrals* may occur depending on the patient's specific MRPs and condition. Interventions may involve the pharmacist working directly with the patient or with other healthcare providers. Moreover, a pharmacist may refer a patient to other healthcare providers, including pharmacists, who have more training and experience. Successful resolution of MRPs involves collaboration and communication between patients, pharmacists, and the patients' healthcare providers.[63]

Finally, pharmacists should *document* service provision and *follow-up* with the patient and/or another healthcare provider. This step allows a pharmacist to evaluate patient progress and it also facilitates communication between the pharmacist and other healthcare providers. Documentation helps pharmacists demonstrate the value of service provision, which is instrumental in obtaining payment for services. Lastly, pharmacists' documentation of service provision may help protect against professional liability.[63]

1.2.2.1 *Impact of Pharmacist-Provided MTM on Outcomes*

Improving clinical outcomes is emphasized by Medicare regarding MTM service provision.[3] In addition, providing MTM services has resulted in cost savings for the U.S. health care system.[5,14,15,17,18] Pharmacists have identified and resolved MRPs and they have helped patients lower medication costs. Patient satisfaction is also an important MTM outcome.[5,13,15,64] The following describes clinical, economic, and satisfaction outcomes resulting from pharmacist provision of MTM.

1.2.2.1.1 Clinical Impact

Pharmacists have identified and resolved unnecessary drug therapy, improper drug selection, inappropriate dosing, drug-drug interactions, adverse drug reactions and poor medication adherence.[7-15] Resolution of MRPs varies from study to study, but range from 45 to 69.1 percent.[6,7,12,15] One study noted that almost one-quarter (24.7%) of MRPs were resolved through education and counseling, whereas the remaining interventions required a change in patients' medication regimen.[8] The most common MRPs identified by pharmacists have been: need to change to a less expensive medication (33.3%-85%),[7,10,12] need additional drug therapy (22%-39.8%),[6,8,14,15] dosage too low (19.9%-26.1%),[14,15] inappropriate prescribing (24%),[9] and nonadherence (9.6%-31.3%).[6,8,12,14,15] One study showed that interventions related to cost savings were most often approved by prescribers.[12] In a study by Barnett et al., which examined pharmacists' provided MTM from 2000-2006, the authors reported that pharmacists averaged 3.2 MTM interventions per patient, with patient education/monitoring as the most common action (85.6%).[16] Another study examined MTM provision between 1998 and 2008 and found that pharmacists provided 38,631 MRPs, of which the most common action was additional medication needed.[15] In a study of MTM service provision via telephone, patients who received the services (i.e., intervention group) compared to the control group had significantly more medication and health-related problems resolved.[10] In addition to detecting and resolving MRPs, pharmacists improved patients' medication, disease state and medical device knowledge. [7]

Regarding medication adherence, one study showed that the most common problems were that patients could not afford medications, did not understand directions, preferred not to take the medication, and forgot to take the medication.[15] Previous research found that after one year of MTM provision, medication adherence for patients who enrolled in MTM were significantly higher than those who did not enroll.[5] Moreover, Medicaid patients who voluntarily

participated in the MTM intervention group had significantly higher medication adherence and persistence than Medicaid patients who did not participate in the MTM program.[11] In addition, statins, insulin, oral hypoglycemic agents, proton pump inhibitors, and angiotensin-converting-enzyme inhibitors were the top five categories of medications associated with nonadherence.[15]

Pharmacists have also focused on various disease states (e.g., hypertension, cardiovascular disorders, diabetes, asthma, and dyslipidemia) when providing MTM.[6,7,13,17,18] The following clinical outcomes resulting from pharmacist-provided MTM include: reduced A1c,[15] decreased blood pressure,[15,18] elevated forced expiratory volume in 1 second (FEV_1),[17] and decreased LDL.[15,18] Moreover, previous research indicates that chronically ill patients who received MTM had lower mortality compared to those who did not.[65]

1.2.2.1.2 Economic Impact

Pharmacists have had an impact on cost savings when providing MTM. Interventions such as substituting lower cost medications for higher cost medications have resulted in substantial cost savings for both the patient and the health care system. MTM provision in the Asheville project resulted in $628 average cost savings per person per year for cardiovascular/cerebrovascular-related medical health plan expenditures.[18] Another study showed that for 207 asthmatic patients, pharmacists were responsible for a direct cost savings that averaged $725 per patient per year, and indirect cost savings that averaged $1,230 per patient per year.[17] Researchers found that pharmacists saved the health care system $2,913,815 over the 10-year period, while the total cost of MTM provision was $2,258,302.[15] Reduction in total prescriptions per patient per month for patients who enrolled in the MTM program was higher than for patients who declined to enroll.[5] Previous research found that, from the third-

party payer perspective, each $1 spent in provision of MTM services saved $12.15 in health care expenditures.[14]

1.2.2.1.3 Patient Satisfaction

Another important MTM outcome is patient satisfaction. Previous research using a 15-item survey to assess MTM satisfaction found that the average satisfaction score (1 = strongly disagree to 5 = strongly agree) for patients was 4.0(±0.6).[64] Moreover, in two studies with 2 and 10 year duration of MTM provision, more than 95 percent of patients were satisfied with the services they received.[5,15] In addition to face-to-face interactions, patients were satisfied with MTM services provided via telephone and videoconference.[5,13]

1.2.2.2 *MTM Barriers and Strategies*

Although research has shown positive outcomes with MTM, pharmacists still have difficulties in providing optimal MTM services. These difficulties can be either unrelated or related to pharmacists. The following section describes these issues, as well as strategies to address them.

1.2.2.2.1 Barriers Unrelated to Pharmacists and Strategies to Address

Barriers not directly related to pharmacists include those involving: (1) pharmacy settings,[19] (2) other healthcare providers,[20-22] and (3) third party payers (e.g., Medicare Part D).[21,23] Compared to community independent pharmacy settings, community chain pharmacies generally have higher reimbursement rates, better documentation systems, and more space for providing MTM.[19] However, previous research indicates that independent pharmacies tend to provide more MTM services than chain pharmacies.[66] One strategy for addressing billing and compensation may be to utilize MTM-specific documentation and billing platforms such as

Mirixa® or OutcomesMTM®. These platforms provide training modules, access to a national network of patients, and internet-based documentation and claims payment processing, as well as data reporting.[16] Another barrier unrelated to pharmacists is other healthcare providers (e.g., physicians, nurses) who may have negative attitudes toward pharmacists and MTM service provision. In a study of 102 West Virginia physicians, Alkhateeb et al., found that 51.5 percent of respondents reported that they never or rarely had contact with a pharmacist regarding patients' medications. Moreover, 60 percent of respondents either agreed or strongly agreed that they supported cooperatively working with pharmacists, whereas only 36 percent supported the provision of MTM by pharmacists. Physicians who had more years of experience and specialists (vs. primary care) were more negative regarding pharmacist provision of MTM.[20] Another study indicated that physicians believed that they were more suitable than pharmacists in providing MTM services.[22] In addition, due to low reimbursement rates for their primary care services, some physicians mentioned that they would like to provide MTM services for additional revenue.[22] Several solutions have been suggested in the literature for improving physician attitudes. First, physicians should receive information about the value of MTM programs in enhancing their patients' health status. Second, pharmacists must demonstrate to other healthcare providers their clinical ability to improve patients' outcomes.[25] Next, regarding physicians' reimbursement concerns, pharmacists can suggest to physicians that pharmacist-provided MTM services may enhance the physicians' reimbursement rate by making them (i.e., physicians) available to see more patients.[22] Fourth, pharmacists can enhance their communication with healthcare providers regarding their role in identifying and resolving MRPs, which may improve the pharmacists' image as important providers on the healthcare team.[67]

The third party payer, specifically Medicare, for MTM presents another barrier. Although Medicare Part D plans named pharmacists as MTM providers, pharmacists have deemed the reimbursement rate as low. Based on the Lewin Group recommendation, pharmacists should be reimbursed for providing MTM at $2 to $3 per minute, or $120 to $180 per hour,[68] which is higher than Medicare Part D's rates of $30 to $50 per hour.[69] One way of addressing the low reimbursement rate may be to adapt Minnesota's approach. In 2006, Minnesota began a program that paid pharmacists for time spent, number of MRPs identified, and number of medical conditions addressed. This type of program, which might result in higher reimbursement rates, may encourage more pharmacists to provide MTM services.[26]

1.2.2.2.2 Barriers Related to Pharmacists and Strategies to Address

Barriers related to pharmacists are within the pharmacists' control and may be more easily modifiable. Pharmacists who provide MTM or who have an interest in providing such services agreed that the following were barriers to providing MTM: lack of specific MTM service practice standards and lack of understanding of MTM services components.[24] Further, pharmacists consider lack of availability of and access to MTM educational resources as barriers to providing MTM services.[24] Of the MTM service components, pharmacists were less confident in their skills to create an action plan for their patients.[70]

Because other healthcare providers (e.g., physicians and nurses) are eligible to provide MTM, pharmacists should make strides to remove these barriers. Most of these barriers related to pharmacists are concentrated in some lack of understanding of MTM programs and a lack of educational resources.[24] To help pharmacists overcome these barriers, the American Pharmacists Association (APhA) offers a variety of training programs that aid pharmacists in providing

optimal patient care. Moreover, the APhA and the American Society of Consultant Pharmacists (ASCP) have developed a specific training program for providing MTM services called "Delivering Medication Therapy Management Services in the Community" (DMTMSC). The DMTMSC enhances pharmacists' clinical skills in assessing complicated medication regimens, identifying MRPs, and providing recommendations to patients, caregivers, and healthcare professionals. In addition, participants have resources to aid them in providing MTM, and participants who are APhA members have access to an MTM e-community for enhancing their MTM services.[27] This type of program, along with other programs, such as Pharmaceutical Care for Diabetic Patients, may enhance pharmacists' confidence, knowledge, and skills in providing optimal MTM services.

Not only should pharmacists be educated and trained to provide MTM, but pharmacy students would also benefit from this as well since it may increase their ability and confidence in providing MTM in the future. The literature indicates that student pharmacists who practice providing patient care services in pharmacy schools tend to be more efficient in providing the same services in their pharmacy settings.[71] For example, student pharmacists who had completed a diabetes concentration course in their pharmacy schools showed more ability and higher confidence in providing care to diabetics than pharmacists who had not.[71] Therefore, pharmacy schools should be eager to educate their students on MTM provision.[72]

1.2.3 MTM Curricula in Colleges/Schools of Pharmacy (C/SOPs) and Outcomes

Training and preparing pharmacy students to provide MTM in the future may help diminish the gap between optimal MTM and current MTM service provision. Furthermore, it may provide pharmacy students with the experience and the confidence needed to provide MTM in their future pharmacy settings.[28,29] The following section discusses MTM courses, specifically

prevalence, type, outcomes, barriers, and evaluation, as well as the impact of MTM courses on students' perceptions regarding future practice.

1.2.3.1 *Prevalence of MTM Courses*

Available literature shows that several C/SOPs in the U.S. offer curricula on MTM service provision.[30-42] Because of the differences in the types of MTM courses provided, the following terms are used to describe the prevalence of MTM courses: entire course[30-32] or part of a course,[33-41] and elective[30,31,37,41,42] or required.[34-36,38-40] (Note: Rovers et al. and Agness et al. studies did not include whether the MTM courses were elective or required.[32,33]) Based on the literature, the courses most likely to include MTM instruction were Pharmacotherapy Laboratory,[35,36,38,39] Advanced Pharmacy Practice Experience,[33,34,37,40,41] and Introductory Pharmacy Practice Experience.[32] In addition, pharmacy students participated in courses that incorporated MTM services training during various professional years, but most often during the third[31,32,35,36,38,39,42] and fourth[37,41] years. However, for elective courses, a combination of students in different professional years were enrolled.[30]

1.2.3.2 *Description of MTM Courses in C/SOPs*

Pharmacy schools teach and/or train students to provide MTM services using different formats, such as: didactic lectures, case studies, proxy or real patients. Didactic lectures typically include information regarding the MTM framework and guidelines on how to identify and resolve MRPs, as well as how to review patients' medications.[31,36,38,39] A second teaching method is case study analysis,[31,36,38,39] which often occurs after didactic lectures. This method of teaching is typically incorporated in laboratory courses where students are divided into subgroups to analyze the cases.[35,38,39] The last type of MTM instruction involves allowing students to provide MTM services to proxy or real patients, which may be particularly effective

in helping students master service provision.[36] The students provide MTM services (to proxy or real patients) as a group (2-8 students)[30,31,36,38] or individually.[32,37,41] Pharmacy faculty members may act as mock patients and receive MTM to evaluate how students are providing the service.[38] Other programs involve students providing MTM to real patients, including elderly patients,[31-33] women,[34] low-income patients,[31] uninsured patients,[30] university faculty members,[36] inpatients,[41] patients at outpatient clinics,[42] and community pharmacy patients.[37] Not all students are able to provide MTM services due to the lack of MTM service provision in some community pharmacies.[37] Moreover, some C/SOPs combine several methods to teach MTM, such as: MTM lectures with proxy or real patients.[31,32,36-38,41] Some C/SOPs, however, use one only one teaching method (e.g., case studies, proxy/real patients) under the assumption that students have already had didactic lectures on the topic.[31,33-35,39,41] Also, other C/SOPs have used documentation software, such as MirixaPro,® or the Tool to Improve Medications in the Elderly via Review (TIMER), to help students understand and provide MTM services to patients.[35,38]

1.2.3.3 *MTM Course Outcomes*

MTM outcomes assessed were dependent on the course objectives, which included increasing: MTM knowledge;[36,39] provision of medication and general health interventions[35,36,38], provision of medication and health education;[41] and identification and/or resolution of MRPs.[32,36,37,41] Additional course objectives included assessing: the impact of using MTM documentation tools on students' provision of MTM services;[38] the correlation between students' and clinical pharmacists' interventions;[33] and the impact of an MTM course on the students' intentions to provide MTM services in the future.[31,37,39] In one study, students' MTM knowledge and ability to provide MTM services were measured after receiving an MTM lecture. As a result, almost two-thirds (64.7%) of students agreed

or strongly agreed regarding their enhanced ability to evaluate patients' medications and analyze their safety and effectiveness; while, 93 percent of students were neutral to strongly disagree regarding their ability to document MTM services.[36] Moreover, patients stated that both their medication understanding and health conditions were improved by student-provided MTM services.[34,36,37] The literature indicated that students were able to detect 0.9 to 2.0 MRPs per patient[32,34,36,37,42] and one medical problem per patient.[32] The type of interventions by students were as follows: adding medication for an untreated indication (7% to 30%),[37,41,42] optimizing the dose of a current medication (9% to 24%),[32,37,41,42] detecting medication nonadherence (12% to 50%),[32,33,42] adding a medication for a new untreated indication (13% to 18.5%),[32,41] changing a current medication to a more appropriate medication (18.5%),[41] detecting adverse drug reactions (13% to 21.0%),[33,37] discontinuing a medication without an indication (7% to 25%),[32,33,41] detecting a drug-drug interaction (15%),[37] changing a drug due to cost (6% to 20%),[37,42] and changing the route of administration (4%).[41]

Resolution of MRPs also resulted from students' provision of MTM services. This was measured by examining the percentage of students' interventions and recommendations that were accepted by patients' healthcare providers. The literature indicated that 53 percent to 75 percent of such interventions were accepted by physicians.[34,37,41] Similarly, in assessing the agreement between students and clinical pharmacists in identifying MRPs, clinical pharmacists agreed with 3 out of 7 medications that students identified as a MRP.[33] Also, the literature indicated that students' confidence in providing MTM services significantly ($p<0.001$) increased after providing MTM services.[36] In another study, the majority of students [96% (2009), 79% (2010)] were

prepared to provide MTM in the future.[37] Moreover, an MTM course compared students' MTM perceptions of and intentions to provide MTM services in the future before and after providing MTM services to patients. The authors found that after providing MTM services, students' perceptions were improved (pre-to post-MTM) with the following: intentions to provide MTM services (66.7% to 88.9%, respectively; p = 0.046),[31] self-perceived pharmacy care skills (74.7% to 78.3%, respectively; p = 0.028),[30] and in general ability to provide various aspects of MTM services (scale: 1=strongly disagree; 5=strongly agree; 2.5-4.3 to 4.1-4.6, respectively; p < 0.006).[36] In another study, the authors stated that integrating tools in MTM courses, such as MirixaPro® helped students understand MTM and increased their confidence in providing MTM services in their future setting.[38] Using TIMER also resulted in significantly (p = 0.02) higher MRPs identified by students.[35]

1.2.3.4 *Barriers to Providing MTM Courses*

Attempts to establish MTM courses in C/SOPs have been limited due to clinical faculty funding, clinic or community pharmacy acceptance, and faculty expertise.[40] Also, students reported that recruiting patients, scheduling the first visit and traveling off campus to provide MTM were the most common difficulties faced in providing MTM services.[32]

1.2.3.5 *MTM Course Evaluation and Student Perceptions*

After providing MTM services to patients, receiving didactic MTM training, and/or analyzing cases, several C/SOPs surveyed students to learn about their perceptions. The literature indicates that students valued the course for increasing their medication knowledge, interpersonal skills and professionalism.[54,60] In addition, they rated their overall personal experience in the

course as positive,[32,36] and they intended to provide MTM services in the future.[31] In one study, 20 out of 32 (62.5%) patients indicated that MTM services provided by students improved their medication knowledge and all of the patients (n=32) responded that they would recommend the students' services to their friends and family.[34] In addition to course evaluations, researchers have assessed students' knowledge and intentions (using the Theory of Planned Behavior) to provide MTM services in the future.[63] This type of assessment may reflect the overall impact of C/SOP's curricula in preparing a new generation of pharmacists to provide MTM services. The researchers showed that most students agreed that MTM courses increased their knowledge of (range 94%-96%) and intention to (range 60%-67%) provide MTM services in the future.[37,73]

1.2.4 The University of Texas at Austin at College of Pharmacy MTM Course

At The University of Texas at Austin College of Pharmacy (UT-COP), an MTM course was developed as a pilot in 2010 and was subsequently offered as a required course for all third-year pharmacy students (P3s), starting Fall 2011, to all campuses. This course, "Clinical Skills: Community Care," was developed to train pharmacist-interns in MTM provision in community pharmacy practice (see Appendices A1 and A2 for the 2010 (pilot) and 2011 course syllabi, respectively). The course objectives were:

> *"(1) Pharmacist-interns will be able to integrate basic clinical and scientific knowledge in the care of ambulatory patients in actual practice settings through the performance of Medication Therapy Management; (2) Pharmacist-interns will review patient medication histories and develop action plans to optimize a patient's medication therapy and outcomes; (3) Educate patients on health and wellness through the development and execution of a public health project; (4) Assess patient safety by performing drug utilization reviews and drug information requests; and (5) Demonstrate longitudinal learning through continued application of patient assessment and immunizations."*

Students are assigned to preceptors in community practice settings and must provide and document complete MTM services for five patients. In addition, students are involved with

public health promotion and patient safety exercises. Additional course components will be explained in more detail in the Methods chapter.

1.2.5 Summary

C/SOPs responded to the demand of educating students regarding MTM. Consequently, the literature showed that C/SOPs provided MTM courses using a variety of formats such as: having an entire course or part of a course; offering the course as required or elective; using teaching formats such as didactic, case studies, proxy/real patients and combinations of the aforementioned. However, none of the studies in the literature described the impact of a required 'entire' MTM course in which all students completed a training program, received lectures, and provided services to patients in community pharmacies. Examining the impact of the UT-COP MTM course on student and patient outcomes may benefit other C/SOPs that are considering adding or revising MTM courses in their curricula. Below is a description of the study objectives and hypotheses.

1.2.6 Objectives and Hypotheses

1. To describe patients' demographic characteristics (age, gender, race), social history (smoking, alcohol and caffeine consumption), and clinical characteristics (medical conditions, prescription medications, over-the-counter (OTC) medications and herbal supplements, and number of medical prescribers)
2. To describe the number and type of medication and health-related problems (MHRPs), MTM interventions, and MTM recommendations.
3. To describe medical provider/patient MTM recommendation acceptance rates.
4. To determine what factors (baseline MHRPs, medical conditions, prescription medications, OTC medications and herbal supplements, MTM interventions, number of medical prescribers, and MTM recommendations) are related to the number of MHRPs resolved (change in MHRPs from baseline to follow-up).

    H1: The number of baseline MHRPs will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

    H2: The number of medical conditions will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

    H3: The number of prescription medications will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

    H4: The number of OTC medications and herbal supplements will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

    H5: The number of MTM interventions will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

    H6: The number of medical prescribers will be positively and significantly related to the number of MHRPs resolved while controlling for other factors.

H7: The number of MTM recommendations will be positively and significantly related to the number of MHRPs resolved while controlling for other factors

CHAPTER TWO: METHODOLOGY

This chapter describes the methodology used to conduct the present study. It provides information about the study setting and the data source, inclusion criteria, and a description of the study intervention. In addition, the study's dependent and independent variables and the statistical tests used are presented.

2.1 STUDY SETTING, INCLUSION CRITERIA AND DATA SOURCE

This is a retrospective study using data from an academic course, Clinical Skills: Community Care, taught at The University of Texas College of Pharmacy (UT-COP). The course was established to help students: (1) integrate clinical and scientific knowledge through providing MTM, (2) review patients' personal medications and create an action plan to maximize the patients' medication outcomes, (3) educate patients on health through the development of public health projects, and (4) evaluate patients' safety by performing a drug utilization review. The course is mandatory for all third-year pharmacy students. Because of the large number of third-year students (121 third-year students), the course was first offered as a mandatory course to 67 students in the Fall 2011 semester, and then to 54 students in the Spring 2012 semester. The present study focuses on the Fall 2011 semester. Moreover, the course was offered at four different campuses (UT Austin, UT Health Science Center San Antonio, UT El Paso, and UT Pan-America). All third-year (P3) Fall 2011 students (on all four UT campuses) who were enrolled in the course were included in the study. As mentioned previously, students were required to complete five patient cases. All adult (≥18) completed, non-duplicative patient cases served as the study population.

2.2 INSTITUTIONAL REVIEW BOARD APPROVAL

The University of Texas at Austin Institutional Review Board approved the study. Moreover, because the data were de-identified (patients' and students' names were removed from the forms), the threat to privacy is minimal.

2.3 COURSE DESCRIPTION

2.3.1 Course Syllabus

The MTM course, PHR 287H - Clinical Skills: Community Care, was developed, coordinated, and taught by Professor Sharon Rush. The purpose of the course was to aid pharmacy students in understanding the profession of pharmacy from a community pharmacy perspective and to prepare pharmacist-interns for their Advanced Pharmacy Practice Experience in their fourth professional year.

The course objectives were to help pharmacist-interns incorporate basic clinical skills in the care of ambulatory patients in real practice settings, to evaluate and optimize patients' medication therapies and outcomes, to develop public health projects to educate patients on health and wellness, to implement drug utilization review and drug information requests to determine patient safety, to perform patient assessments and to administer immunizations. See Appendix A2 for the course syllabus.

The primary prerequisite for the course was having completing the second professional year in the College of Pharmacy. P3 students were assigned to a preceptor and required to participate in community/ambulatory care-specific activities. Completion of 80 experiential hours at approximately 4-6 hours per week was required. All students were required to participate in activities related to the following: (1) Medication Therapy Management, which included completing the national certificate of the American Pharmacists Association's

(APhA's) "Delivering Medication Therapy Management Services in the Community" and completing five comprehensive Medication Review MTM cases; (2) public health promotion, which included activities to improve the health and wellbeing of patients; (3) patient safety exercises, which included completing one drug utilization review, one drug information request, and one medication calendar for an MTM patient; (4) reflections on experiences, which required the students to report weekly on what they learned; and (5) any two of the following elective activities: administration of immunizations, demonstration of patient assessment skills (e.g., health screenings), or other requested by the preceptor. In addition, students were encouraged to read literature, such as "Medication Therapy Management on Pharmacy Practice: Core Elements of an MTM Services Model" – version 2.0, Motivational Interviewing, as well as other handouts assigned by the instructor. All the required documentation, such as MTM forms, public health forms, patient safety forms, and electives forms, were placed on Blackboard, a web-based course management system, which allowed the students to access the documents.

A student's schedule in his or her assigned practice was determined by both the preceptor and the student. Moreover, the student, the preceptor, and the practice site determined the number of hours scheduled each week, which might include working at night or weekends. Students' hours at their practice site had to be divided approximately as follows: 70 percent for MTM, 15 percent for public health, 5 percent for patient safety, and 10 percent for elective experiences. All students were also required to abide by all the pharmacy sites' rules and regulations.

2.3.2 MTM Form

The MTM form (Appendix A3) was used by students in the provision and documentation of MTM services. It was divided into five sections: (1) Medication Therapy Review, (2)

Pharmacist Action Plan, (3) Pharmacist Action Plan Progress Notes, (4) Patient Medication Record, and (5) Patient Medication Action Plan. The following describes each section.

2.3.2.1 Medication Therapy Review (MTR)

The Medication Therapy Review section was formatted based on the information supplied to the student by the patient. This section was to remain in the patient's file at the practice setting to be used as a reference in communicating with the patient's other healthcare providers. In addition to the student's name, the date prepared, and the practice setting's name and phone number, this section included the patients' name, year of birth, race, sex, height, weight, blood pressure, and blood glucose. The students also documented the reason that brought the patient to receive MTM services, whether a comprehensive review or a targeted visit (e.g., checking on a particular health problem or concern) was needed. The student documented any question the patient might have about his or her medication or disease or condition. This section included type, duration and frequency of smoking, alcohol and caffeine use. Medication allergies and adverse medication reactions, as well as medical conditions, such as alcoholism, breastfeeding, depression, heart failure, obesity, and others, were included in this section. Next, the student documented all medication-related information for prescription medications, over-the-counter medications, and herbal supplements, which included name, dose, directions, indications, prescribing physician, and comments. This information was to help the student understand what medications and supplements the patient used, how the patient used them, and what information the patient knew about them. Also, the student recorded patient immunization status. In conclusion, this section was necessary to students in providing MTM services because it provided important information to help students identify and resolve MRPs.

2.3.2.2 Pharmacist Action Plan (PAP)

After reviewing the patient's personal medication therapy, the student created the Pharmacist Action Plan (PAP). The PAP documented the MRPs, the priority level (i.e., high, medium, and low) of these problems, and the intervention proposed to resolve each particular problem. Moreover, the student was to document if he or she had advised the patient to follow up with other healthcare providers, as well as the outcomes that resulted from identifying MRPs. Also, the students were to indicate whether they provided a copy of the PMR and MAP to the patient, made a referral to other healthcare providers, and to whom they had referred the patient.

2.3.2.3 Pharmacist Action Plan Progress Notes

This section was used to document student interventions and whether s/he followed up with the patient. This was used as a summary for the MTM service and as a measurement of the overall effectiveness of the MTM service. It also enabled effective communication between pharmacy staffs and students concerning the progress of the case.

2.3.2.4 Patient Medication Record (PMR)

In this section, students recorded all patient medications and herbal supplements on a Patient Medication Record (PMR), and they advised patients to carry it with them to share with other healthcare providers. The information included names of all medications and supplements, doses, indications, prescriber names, dose times, and any special instructions.

2.3.2.5 Patient Medication-Related Action Plan (MAP)

After creating the PAP, the students provided patients with their own personal medication-related action plans (MAPs). In addition to the patient's name and date of birth, as well as the name and the phone number of his or her primary physician and pharmacy, the

student had to provide the patient with the critical steps that would help him or her have optimal outcomes. The student also encouraged the patient to accomplish those steps with the patient's other healthcare providers and to document what and when those steps were completed.

2.4 STUDY VARIABLES

Below is a description of the dependent and independent variables used in the study. Table 2.1 summarizes the variables and their operational definitions.

2.4.1 Dependent Variables

2.4.1.1 Medication and Health Related Problems (MHRPs)

The MTM interventions captured more than MRPs, they also included disease management and preventive care problems. Thus, the term Medication and Health Related Problems (MHRPs) will be used to represent the dependent variable. Patients' MHRPs at baseline are the number of MHRPs that were identified by students during the first MTM visit. Similarly, patients' MHRPs at follow-up were identified during the follow-up visit (if any). Prior to deidentification, patients' baseline and follow-up visits were matched by using the following data: age, race, gender, primary physician's name and phone number, and primary pharmacy's name and phone number. A form, adapted from Moczygemba et al.,[74] was created to document the number and type of MHRPs (See Appendix A4). After reviewing several documented student MTM forms, MHRP categories were added and/or modified to address the study objectives (see Appendix A5) and further detail below in Section 2.4.2.2.

2.4.1.2 Resolution of MHRPs

Resolution of MHRPs was calculated for patients who had follow-up visits and was identified by any change in the number of MHRPs from baseline to follow-up MTM visits (i.e.,

Number of MHRPs baseline-Number of MHRPs follow-up). Patients who had a follow-up visit could be identified by matching their data as described above.

2.4.1.3 Acceptance Rate of MTM recommendations

At follow-up visits (if any), patients were asked to determine whether they/their healthcare providers accepted MTM recommendations. Acceptance rates were calculated for patients with follow-up visits as: *Provider/patient MTM recommendations acceptance / Number of MTM recommendations made*.

2.4.2 Independent Variables

2.4.2.1 Patient Demographics and Social History

Demographic variables were age, gender, and race. Age was a continuous variable and represented the age of patients in years at the time of MTM services. Gender was a dichotomous variable and coded as 1 for male and 2 for female. Race was categorical and coded as 1 for White, 2 for African American, 3 for Hispanic, 4 for Asian, and 5 for other races. Social history included whether or not the patient smoked or drank alcohol (1 = Yes, 0 = No).

2.4.2.2 Number and Type of MTM Interventions and Recommendations

Students' MTM interventions and recommendations were reviewed and classified into groups (see Appendix A5). Students' interventions related to the identification of MHRPs were classified into eight categories, problems related to: (1) drug product selection; (2) drug regimen; (3) precautions, interactions, and contraindications; (4) adverse effects and use; (5) Immunization; (6) social history and life style issues; (7) lack of understanding drug indication and continuity of care; and (8) disease monitoring and control. Students' interventions included actions such as contacting other healthcare providers, counseling patients/caregivers, which

included providing them with verbal or written instructions on taking the medications, educating patients, which included providing them with verbal or written instructions on overall health, or referring the patients to other healthcare providers. Likewise, students' MTM recommendations were also classified into groups as follows: recommendations related to (1) medications, (2) preventive care, (3) immunizations, (4) diabetic, hypertensive, and dyslipidemic patients, and (5) smoking and alcohol use.

2.4.2.3 Patients' Clinical Characteristics

The medical conditions were defined as the total number of disease(s) that patients had at the time of MTM services. The total number of patients' prescription medications and total number of over-the-counter and herbal supplements used at the time of MTM services were documented. Walgreens Preferred Medication List — Medication Category Guide (see Appendix A6) was used to classify patients' medications into categories. Lastly, the total number of medical prescribers was documented as well as the type of immunizations that patients obtained at baseline.

Table 2.1 Description of Study Variables

Variable	Operational Definition
DEPENDENT VARIABLES	
Medication and health related problems	Number of MHRPs at baseline and follow-up
Medication and health related problems resolved	Change in number of MHRPs from baseline to follow-up
Acceptance rate of MTM recommendations	Provider/patient MTM recommendations acceptance / Number of MTM recommendations
INDEPENDENT VARIABLES	
Demographics and Social History	
Age	Age (years) at baseline
Race	1 = White, 2 = African American, 3 = Hispanic, 4 = Asian, 5 = Others
Gender	1 = Male, 2 = Female
Smoking	0 = No, 1 = Yes
Caffeine	0 = No, 1 = Yes
Alcohol use	0 = No, 1 = Yes
Clinical Characteristics	
Number and type of MTM interventions and recommendations	(See Appendix A5) MTM interventions related to: (1) Drug product selection; (2) Drug regimen; (3) Precautions, contraindications, and interactions; (4) Adverse effects and use; (5) Immunization; (6) Social history and life style issues; (7) Lack of understanding drug indication and continuity of care; and (8) Disease monitoring and control. MTM recommendations related to: (1) Medications, (2) Preventive care, (3) Immunizations, (4) Diabetic, hypertensive, and dyslipidemic patients, and (5) Smoking and alcohol use
Medical conditions	Total number of medical conditions at baseline
Prescription medications	Total number of prescription medications at baseline
Over-the-counter medications and herbal supplements	Total number of OTCs and herbal supplements at baseline
Medical prescribers	Total number of medical prescribers at baseline
Immunizations	Type of immunizations at baseline

2.5 STATISTICAL ANALYSIS

Several statistical analysis tests were used to address the study objectives. SAS version 9.3 was used and a significance level of $p < 0.05$ was chosen. Table 2.2 describes the statistical analyses that were conducted to address the study objectives. Descriptive statistics (i.e., mean,

standard deviation, frequency) were used to address study objectives 1-3 and multiple linear regression was used to address objective 4. The following three assumptions must be met to conduct multiple regression: (1) independent observations; (2) normally distributed dependent variables; and (3) linearity between dependent and the independent variables. Because each student is providing MTM services independently, the first assumption is met. Moreover, a histogram of the standardized residuals was used to check the assumption of normality, while residual plots were used to check for linearity.[75] Following is the multiple regression equation that was used in the study.

$$Y'=a+b_1X_1+b_2X_2+b_3X_3+b_4X_4+b_5X_5+b_6X_6+b_7X_7$$

Following are the model variables:

Y' = Change in the number of MHRPs from baseline to follow-up

X_1: Baseline MHRPs

X_2: Medical conditions

X_3: Prescription medications

X_4: OTC medications and herbal supplements

X_5: MTM interventions

X_6: Medical prescribers

X_7: MTM recommendations

Table 2.2: Data Analysis Plan

OBJECTIVE 1: To describe patients' demographic, Social History, and clinical characteristics		
Variables	**Measurement level**	**Analysis**
Age	Continuous	Descriptive statistics (e.g., mean, frequency)
Gender	Dichotomous	
Race	Categorical	
Smoking	Dichotomous	
Alcohol use	Dichotomous	
Caffeine use	Dichotomous	
Medical conditions	Continuous	
Prescription medications	Continuous	
OTC and herbal supplements	Continuous	
Medical prescribers	Continuous	
Number of immunizations	Continuous	
OBJECTIVE 2: To describe the number and type of medication and health related problems (MHRPs) and MTM interventions and recommendations		
Variables	**Measurement level**	**Analysis**
Number of MHRPs	Continuous	Descriptive statistics (e.g., mean, frequency)
Type of MHRPs	Categorical	
Number of MTM interventions	Continuous	
Type of MTM interventions	Categorical	
Number of MTM recommendations	Continuous	
Type of MTM recommendations	Categorical	
OBJECTIVE 3: To describe the medical provider/patient acceptance rate of MTM recommendations		
Variables	**Measurement level**	**Analysis**
Medical provider acceptance rate of the types of MTM recommendations	Continuous	Descriptive statistics (i.e., mean)

OBJECTIVE 4: To determine what factors are related to the number of MHRPs resolved				
DV	**Measurement level**	**IV**	**Measurement level**	**Analysis**
MHRPs resolved	Continuous	Baseline MHRPs Medical conditions Prescription medications OTC and herbal supplements MTM interventions Medical prescribers MTM recommendations	Continuous	Multiple regression

2.6 SAMPLE SIZE ANALYSIS

Calculating the needed sample size is important to ensure the adequacy of the study power and then avoid having a high Type II error, which lead to incorrectly accepting the null Hypothesis. In order to calculate the needed ample size, three components have to be determined. These components are: 1) the critical p-value, Alpha (α); 2) study power; and 3) the study effect size. Prior to conduct the study, the three components were determined as following: Alpha (α) equal to 0.05, power equal to 0.80; and a medium effect size (R^2 = 0.13) based on conventional values.[76] Based on the formula in Figure 2.1 and seven independent variables,[76] , the total required sample size was 104.

Figure 2.1 Formula for Calculating Multivariate Regression Sample Size

$N = (L/\gamma) + k + 1 \qquad \gamma = \text{effect size} = R^2/(1-R^2)$

N = estimated sample size
L = tabled value for the desired α and power
K = number of predictors
γ = estimated effect size
R^2 = percent of variance explained by the model

CHAPTER THREE: RESULTS

This chapter includes the study results. The first section describes the study's inclusion criteria and the total number of patient cases. Then, the patients' demographics, social histories, and clinical characteristics are detailed. The next section describes the medication and health related problems (MHRPs), interventions, and recommendations that were identified and provided by pharmacist-interns. Following, the chapter describes the acceptance rate of pharmacist-interns' recommendations, and lastly, the study hypotheses will be described.

3.1 INCLUSION CRITERIA

This study used the MTM cases that were documented by pharmacist-interns during the provision of MTM services. A total of 335 cases were documented as receiving MTM services. Sixty-one cases did not meet the inclusion criteria for the following reasons: patient <18 years (n=4); duplicated case (n=52); and incomplete documentation (n=5). The final total sample was 274 patient cases.

3.2 PATIENTS DEMOGRAPHICS, SOCIAL HISTORIES, AND CLINICAL CHARACTERISTICS

Patient's demographics, social histories, clinical characteristics are described below (see Tables 3.1 - 3.12).

3.2.1 Patients' Demographics

Patients' demographics, which included patients' age, gender, and race, are detailed in tables 3.1-3.3. The patients' average age was 63.8 (± 14.5), and the majority of patients were 55-74 years old (52.5%) (see Table 3.1). Female patients accounted for 60.4 percent of total patients (see Table 3.2), and Caucasians accounted for 53.2 percent of patients, followed by Hispanics (37.8%) (see Table 3.3).

Table 3.1 Mean and Frequency Distribution of Age		
Age	Number	Percent (%)
18-34	10	4.2
35-44	15	6.4
45-54	30	12.7
55-64	60	25.4
65-74	64	27.1
75-84	44	18.6
> 85	13	5.5
Total	236[a]	99.9[b]

Mean age (SD): 63.8 (±14.5)
[a] 38 responses were missing.
[b] Total does not equal 100 percent due to rounding.

Table 3.2 Frequency Distribution of Gender		
Gender	Number	Percent (%)
Male	108	39.6
Female	165	60.4
Total	273[a]	100.0

[a] 1 response was missing.

Table 3.3 Frequency Distribution of Race		
Race	Number	Percent (%)
Caucasian	124	53.2
Hispanic	88	37.8
African American	13	5.6
Asian	6	2.6
Other [a]	2	0.9
Total	233[b]	100.1[c]

[a] Other included Indian and Iranian.
[b] 41 responses were missing.
[c] Total does not equal 100 percent due to rounding.

3.2.2 Patients' Social History

Patients' social history included smoking cigarettes, drinking alcohol and caffeinated beverages. Almost two-thirds (65.2%) were caffeine drinkers, while almost one-third (30.7%) drank alcohol (see Table 3.4).

Table 3.4 Frequency Distribution of Tobacco Smokers, Alcohol Beverage Drinkers, and Caffeine Beverages Drinkers

Categories	Number	Percent (%)
Tobacco smokers Total N=267[a]	33	12.4
Alcohol drinkers Total N = 267[b]	82	30.7
Caffeine drinkers Total N = 253[c]	165	65.2

[a] 7 responses were missing.
[b] 7 responses were missing.
[c] 21 responses were missing.

3.2.3 Patients' Clinical Characteristics

Patients' clinical characteristics included number and type of medical conditions, number and type of prescription medications, number and type of over-the-counter (OTC) medications and herbal supplements, number of medical prescribers, and number and type of immunizations. The average number of medical conditions was 6.0 ($\pm$2.7), and the highest frequency of patients had 5-6 medical conditions (32.9%) (see Table 3.5). More than one-half of patients had hypertension (80.7%), dyslipidemia (67.9%), and diabetes (55.8%) (see Table 3.6).

Table 3.5 Mean and Frequency Distribution of Number of Medical Conditions		
Number of Medical Conditions	Number	Percent (%)
0	1	0.4
1-2	16	5.8
3-4	72	26.3
5-6	90	32.9
7-10	78	28.5
11-15	17	6.2
Total	274	100.1[a]

Mean number of medical conditions (SD): 6.0 (±2.7)
[a] Total does not equal 100 percent due to rounding.

Table 3.6 Top 10 Most Prevalent Medical Conditions		
Medical Condition	Number	Percent (%)
Hypertension	221	80.7
Dyslipidemia	186	67.9
Diabetes	153	55.8
Depression	110	40.2
Arthritis	87	31.8
Chronic pain	83	30.3
Gastrointestinal disorder	77	28.1
Thyroid disorder	72	26.3
Obesity	57	20.8
Heart disease	50	18.3

The mean number of prescription medications was 9.2 (±4.0), and the highest frequency of patients (30.7%) had 7-9 prescription medications (see Table 3.7). The mean number of OTC medications was 2.2 (±2.0), and most (28.1%) were using one OTC medication (see Table 3.8).

Table 3.7 Mean and Frequency Distribution of Number of Prescription Medications		
Number of Prescription Medications	Number	Percent (%)
1-3	13	4.7
4-6	59	21.5
7-9	84	30.7
10-12	75	27.4
³ 13	43	15.7
Total	274	100.0

Mean number of prescription medications (SD): 9.2 (±4.0)

Table 3.8 Mean and Frequency Distribution of Number of Over-the-Counter (OTC) Medications		
Number of Over-the-Counter (OTC) Medications	Number	Percent (%)
0	52	19.0
1	77	28.1
2	46	16.8
3	27	9.9
4	39	14.2
³ 5	33	12.0
Total	274	100.0

Mean number of over-the-counter medications (SD): 2.2 (±2.0)

The Walgreens Preferred Medication List was used to classify medications based on their therapeutic categories. Over one-half of patients used medications classified as blood pressure agents (82.9%), analgesic agents (71.9%), cholesterol agents (67.2%), vitamins, minerals, or electrolytes (59.9%), and diabetic agents (54.0%), (see Table 3.9).

The mean number of herbal supplements was 0.5 (±1.3), and the majority (81.0%) did not use any herbal supplements (see Table 3.10).

Table 3.9 Frequency Distribution of Medication Category

Medication Type	Number	Percent (%)
Blood pressure agents	227	82.9
Analgesics	197	71.9
Cholesterol agents	184	67.2
Vitamins, minerals & electrolytes	164	59.9
Diabetic agents	148	54.0
Antidepressants	120	43.8
Gastrointestinal agents	119	43.4
Hormones	114	41.7
Diuretics	89	32.5
Anticonvulsants	73	26.6
Anticoagulation therapies	63	23.0
Antiasthmatics and COPD[a] agents	62	22.6
Cough, cold, and allergy agents	58	21.2
Musculoskeletal agents	51	18.7
Antianxiety agents	48	17.5
Urologic agents	47	17.2
Eye, ear, nose, and throat agents	46	16.8
Sleep aids	45	16.4
Anti-infectives	21	7.7
Antipsychotics	21	7.7
Heart rhythm stabilizers	17	6.2
Alzheimer's agents	10	3.7
Antiparkinsonism agents	10	3.7
Skin agents	8	3.0
Migraine agents	5	1.8
HIV[b] agents	4	1.5
Oncology agents	1	0.4
Others	91	33.2

[a] Chronic obstructive pulmonary disease
[b] Human immunodeficiency virus

Table 3.10 Mean and Frequency Distribution of Number of Herbal Supplements		
Number of Herbal Supplements	Number	Percent (%)
0	222	81.0
1-2	31	11.3
³ 3	21	7.7
Total	274	100.0

Mean number of herbal supplements (SD): 0.5 (±1.3)

The mean number of medical prescribers was 2.4 (±1.5), and the majority (62.8%) had one (31.1%) or two (30.7%) medical prescribers (see Table 3.11). Regarding immunizations, almost one-half of patients received the influenza (51.5%) and pneumococcal (50.0%) vaccines (see Table 3.12).

Table 3.11 Mean and Frequency Distribution of Number of Medical Prescribers		
Number of Medical Prescribers	Number	Percent (%)
1	77	31.1
2	76	30.7
3	47	19.0
4	23	9.3
³ 5	25	10.1
Total	248[a]	100.2[b]

Mean number of medical prescribers (SD): 2.4 (±1.5)
[a] 26 responses were missing.
[b] Total does not equal 100 percent due to rounding.

Table 3.12 Frequency Distribution of Immunizations Type

Type of Immunization[a]	Number	Percent (%)
Influenza (N= 229)	118	51.5
Pneumococcal (N= 184)	92	50.0
Tdap (N= 141)	64	45.4
Hepatitis B (N= 135)	47	34.8
Hepatitis A (N= 134)	41	30.6
Zostavax/shingles (N= 147)	31	21.0
Meningococcal (N= 120)	28	23.3

[a] N Does not equal 274 due to missing values.

3.3 IDENTIFICATION OF MEDICATION AND HEALTH-RELATED PROBLEMS (MHRPS) AND MTM INTERVENTIONS

The core of this study, aside from MTM outcomes, is examining pharmacist-interns' identification of patients' medication and health related problems (MHRPs) and MTM interventions. To provide MTM services, pharmacist-interns were encouraged to meet patients face-to-face; however, due to conflicts, some pharmacy students provided MTM via telephone.

3.3.1 Identification of MHRPs

MHRPs were initially classified into problems related to medications, immunizations, social histories and lifestyle issues, lack of understanding drug indications and continuity of care, and disease monitoring and control. First, MHRPs were classified into problems related to (1) drug product selection; (2) drug regimen; (3) drug precautions/ interactions/contraindications; and (4) drug adverse effects and use (see Tables 3.13 – 3.16). Regarding problems related to

OTC medications and herbal supplement, pharmacist-interns were able to identify at least one problem in 20.4 percent of patients (see Table 3.13). The most commonly identified medication problems were OTC and herbal supplement use, cost/formulary interchange and duplication (see Table 3.13).

Table 3.13 Frequency Distribution of Type of Problems Related to Drug Product Selection (N=274)

Problem	Number identified	N	Percent (%)
Over-the-counter (OTC) and herbal medications	0	218	79.6
	1	44	16.0
	2	9	3.3
	3	3	1.1
Cost/formulary interchange	0	235	85.8
	1	31	11.3
	2	5	1.9
	3	3	1.1
Duplication	0	235	85.8
	1	37	13.5
	2	2	0.7
Drug safety	0	236	86.1
	1	33	12.0
	2	3	1.1
	3	2	0.7
Drug needed but not prescribed	0	239	87.2
	1	30	11.0
	2	2	0.7
	3	3	1.1
Drug efficacy	0	243	88.7
	1	28	10.2
	2	3	1.1
Prescribed drug not needed	0	268	97.9
	1	5	1.8
	2	1	0.4

Table 3.14 shows the highest frequencies of problems related to drug regimen were medication dose, with at least one found in 14.6 percent of patients, followed by problems related to schedule/duration in 14.2 percent of patients. No problems were found related to route of administrations (see Table 3.14).

Table 3.14 Frequency Distribution of Type of Problems Related to Drug Regimen (N=274)

Problem	Number Identified	N	Percent (%)
Dose	0	234	85.4
	1	36	13.1
	2	3	1.1
	3	1	0.4
Schedule/duration	0	235	85.8
	1	27	9.9
	2	9	3.3
	3	3	1.1
Medication administration technique	0	263	96.0
	1	10	3.7
	2	1	0.6
Dosage form	0	272	99.3
	1	2	0.7
Route of administration	0	247	100.0
Other[a]	0	281	98.9
	1	3	1.1

[a] Insulin injection site

Furthermore, for problems related to precaution/interaction/contraindication, the highest percentage of problems was found related to drug interaction, with at least one problem in 48.5 percent of patients, and at least two problems in 22.3 percent of patients (see Table 3.15). Additionally, regarding problems related to adverse effects and use, 23.0 percent of patients had at least one problem related to additive effect, and 20.8 percent of patients were having at least one problem related to underuse (see Table 3.16).

Table 3.15 Frequency Distribution of Type of Problems Related to Precautions/Interactions/Contraindications (N=274)

Problem	Number Identified	N	Percent (%)
Drug interaction	0	141	51.5
	1	72	26.3
	2	33	12.0
	3	12	4.4
	4	9	3.3
	5	6	2.2
	10	1	0.4
Disease or condition	0	239	87.2
	1	26	9.5
	2	2	0.7
	3	6	2.2
	4	1	0.4
Food	0	260	94.9
	1	12	4.4
	2	2	0.7
Alcohol	0	263	96.0
	1	8	2.9
	2	1	0.4
	3	2	0.7
Age	0	271	98.9
	1	3	1.1
Laboratory	0	274	100.0
Pregnancy/Nursing	0	274	100.0

Table 3.16 Frequency Distribution of Type of Problems Related to Adverse Effects and Use (N=274)

Problem	Number Identified	N	Percent (%)
Additive effect	0	211	77.0
	1	47	17.2
	2	8	2.9
	3	6	2.2
	4	2	0.7
Underuse	0	217	79.2
	1	42	15.3
	2	10	3.7
	3	2	0.7
	4	1	0.4
	7	1	0.4
	8	1	0.4
Allergy	0	268	97.8
	1	5	1.8
	2	1	0.3
Overuse	0	270	98.5
	1	3	1.2
	2	1	0.4
Toxicity	0	272	99.3
	1	2	0.7

The next problem was related to immunizations needed. Although 54 percent of patients had no problems related to immunizations, 19.8 percent of patients had at least two problems related to immunizations needed (see Table 3.17). Regarding social history and lifestyle issues, the most common problems were poor diet (14.2%), obesity (13.9%) and lack of exercise (11.0%) (see Table 3.18).

Table 3.17 Frequency Distribution of Type of Problems Related to Immunizations (N=274)		
Lack of Immunization	Number	Percent (%)
0	148	54.0
1	72	26.3
2	29	10.6
3	15	5.5
4	7	2.6
5	2	0.7
6	1	0.4
Total	274	100.1[a]

[a] Total does not equal 100 percent due to rounding

Table 3.18 Frequency Distribution of Type of Problems[a] Related to Social History and Lifestyle Issues (N=274)		
Problem	Number	Percent (%)
Social History [b]		
Smoking	14	5.1
Alcohol	1	0.4
Lifestyle Issues		
Poor diet	39	14.2
Obesity	38	13.9
Lack of exercise	30	11.0
Poor sleep	7	2.6

[a] Problems were identified by students
[b] Problems related to caffeine consumption were included in drug-food interaction (see Table 3.15)

Overall, patients understood drug indications and continuity of care with less than 7 percent having problems in this area. (see Table 3.19). The last group of problems was related to disease monitoring and control. Diabetic patients had more problems related to their disease state than hypertensive and dyslipidemic patients. Most of the problems were related to poor self-monitoring (see Table 3.20).

Table 3.19 Frequency Distribution of Type of Problems Related to Lack of Understanding Drug Indication and Continuity of Care (N=274)

Problem	Number Identified	N	Percent (%)
Lack of understanding drug indication	0	257	93.8
	1	15	5.5
	2	2	0.7
Continuity of care	0	261	95.3
	1	13	4.7

Table 3.20 Frequency Distribution of Type of Problems Related to Disease Monitoring and Control (N=274)

Type of Disease	Problem	Number	Percent (%)
Hypertension (N= 221)	Poor self-monitoring of blood pressure	28	12.7
	Lack of blood pressure lab	2	0.9
Diabetes (N= 153)	Poor self-monitoring of blood glucose	23	15.0
	Lack A1C check	5	3.3
	Lack of eye exam	6	3.9
	Lack of foot inspection	6	3.9
Dyslipidemia (N= 186)	Poor self-monitoring of lipid	4	2.2
	Lack lipid panel	7	3.8

Finally, Table 3.21 summarizes the means of all MHRPs identified by pharmacist-interns. The table shows that problems related to precaution/interactions/ contraindications (1.2 (±1.6)) and product selection (1.1(±1.2)) had the highest means among all types of problems; whereas lack of understanding drug indication and continuity of care had the lowest mean number of problems identified (see Table 3.21).

Table 3.21 Mean of Medication and Health-Related Problems Summary (N=274)		
Type of Problem	Mean	Standard Deviation
Precautions/interactions/contraindications	1.2	1.6
Product selection	1.1	1.2
Immunization	0.8	1.1
Adverse effects and use	0.7	1.1
Social histories and lifestyle issues	0.5	0.8
Drug regimen	0.4	0.8
Disease monitoring and control	0.3	0.8
Lack of understanding drug indication and continuity of care	0.1	0.4

3.3.2 MTM Interventions

MTM intervention refers to the interventions that pharmacist-interns provided prior to recommending any changes in a patient's medications, health, social histories and/or lifestyle. It included contacting patients' healthcare providers, asking patients to contact their healthcare providers, counseling patients/caregivers, education, and referral. Pharmacist-interns contacted 26.6 percent of patients' healthcare providers; in contrast, 29.2 percent of patients were asked to contact their own healthcare providers. Furthermore, 59.1 percent of patients/caregivers were counseled regarding their medications. Also, pharmacists-interns referred 42.0 percent of patients to other healthcare providers (see Table 3.22).

Table 3.22 Frequency Distribution of Type of Pharmacist-Intern Interventions (N=274)		
Type of Intervention	Number	Percent (%)
Education	193	70.4
Counseled patient/caregiver	162	59.1
Referral	115	42.0
Asked patient to contact healthcare provider	80	29.2
Pharmacist-intern contacted healthcare provider	73	26.6

3.4 PHARMACIST-INTERN'S RECOMMENDATIONS AND OUTCOMES

Based on patients' MHRPs, pharmacist-interns provided patients with recommendations to address their problems. These recommendations were classified into to the following: (1) medications; (2) preventive care; (3) immunizations; (4) diabetes, hypertension, and dyslipidemia monitoring and control; and (5) smoking and alcohol. These were then further classified into: (a) outcomes related to medication-related recommendation (MRRs) (1 above) and (b) outcomes related to health-related recommendation (HRRs) (2-5 above). Pharmacist-interns' recommendations and outcomes results are detailed in the following paragraphs.

3.4.1 Recommendations

Between 20 percent and 30 percent received at least one recommendation related to changing prescription medication, changing schedule/duration, drug efficacy/safety lab monitoring, or OTC and herbal supplement. While less than 2 percent patients had recommendations related to request refill, change route and other, 7 to 15 percent of patients had at least one recommendation related to changing dose, adding drug(s), and discontinuing drug(s) (see Table 3.23).

Table 3.23 Frequency Distribution of Type of Pharmacist-Interns' Recommendations Related to Drugs (N=274)

Type of Recommendations	Number of Recommendations	Number	Percent (%)
Over-the-counter (OTC) medication and herbal supplement recommendation	0	203	74.1
	1	52	19.0
	2	14	5.1
	3	3	1.1
	4	2	0.7
Drug efficacy/safety lab monitoring	0	192	70.1
	1	62	22.6
	2	11	4.0
	3	4	1.5
	4	3	1.1
	5	1	0.4
	6	1	0.4
Change schedule/duration	0	193	70.4
	1	52	19.0
	2	18	6.6
	3	10	3.7
	4	1	0.4
Change drug	0	206	75.2
	1	56	20.4
	2	8	2.9
	3	3	1.1
	4	1	0.4
Change dose	0	235	85.8
	1	35	12.8
	2	3	1.1
	3	1	0.4
Add drug	0	293	87.2
	1	30	11.0
	2	3	1.1
	4	2	0.7
Discontinue drug	0	253	92.3
	1	19	6.9
	2	2	0.7

Table 3.23 (continued)Frequency Distribution of Type of Pharmacist-Interns' Recommendations Related to Drugs (N = 274)

Type of Recommendations	Number of Recommendations	Number	Percent (%)
Change dosage form	0	271	98.9
	1	2	0.7
	2	1	0.4
Change drug to over-the-counter (OTC)	0	272	99.3
	1	2	0.7
Change route	0	273	99.6
	1	1	0.4
Request refill	0	273	99.6
	1	1	0.4

Next, among recommendations related to preventive care, the highest percentage of recommendations was related to health lab monitoring, with 10.9 percent of patients having at least one recommendation (see Table 3.24). Moreover, recommendations related to health lab monitoring were identified as any recommendation related to monitoring patients' bodily fluids (e.g., patient electrolyte and enzymes) except monitoring blood glucose and cholesterol.

More than 10 percent of patients need immunizations with influenza (28.7%) followed by pneumococcal (19.7%), zoster (17.3), and tetanus (11.3%). Less than 4 percent were recommended to receive Hepatitis A or B, and Meningococcal vaccines (see Table 3.25). For recommendations related to diabetes, hypertension, and dyslipidemia monitoring and control, the highest percentage of recommendations was related to hypertension care, with 23.4 percent of patients being recommended to monitor their blood pressure and/or bring a record of their blood pressure measurements, while 13.1 percent were recommended to monitor their blood glucose (see Table 3.26). Finally, 7.3 percent of patients received recommendations related to smoking,

and 3.3 percent of patients received recommendations related to alcohol consumption (see Table 3.27).

Table 3.24 Frequency Distribution of Type of Pharmacist-Interns' Recommendations Related to Preventative Care (N=274)

Type of Recommendations	Number of Recommendations	Number	Percent (%)
Health lab monitoring	0	244	89.1
	1	25	9.1
	2	4	1.5
	4	1	0.4
Cholesterol	0	259	94.5
	1	15	5.5
Depression screening	0	273	99.6
	1	1	0.4
Mammography/breast exam	0	274	100.0
Pap smear	0	274	100.0
Sigmoidoscopy/colonoscopy	0	274	100.0
Stool occult blood	0	274	100.0

Table 3.25 Frequency Distribution of Type of Pharmacist-Interns' Immunization Recommendations (N=274)

Type of Recommendations	Number	Percent (%)
Influenza	78	28.7
Pneumococcal	54	19.7
Zostavax/shingles	48	17.3
Tetanus	31	11.3
Hepatitis B	10	3.7
Hepatitis A	8	2.9
Meningococcal	6	2.2

Table 3.26 Frequency Distribution of Type of Pharmacist-Interns' Diabetes, Hypertension, and Dyslipidemia Care Recommendations (N=274)

Type of Recommendations	Number	Percent (%)
Blood pressure monitoring/request blood pressure lab	64	23.4
Blood glucose monitoring/ request A1c lab	36	13.1
Foot exam	21	7.7
Eye exam	16	5.8
Lipid panel	8	2.9

Table 3.27 Frequency Distribution of Type of Pharmacist-Interns' Education Recommendations (N=274)

Type of Recommendations	Number	Percent (%)
Smoking cessation	20	7.3
Alcohol	9	3.3

3.4.2 MTM Outcome

The following section describes the outcome of pharmacist-interns' recommendations, which refers to the percentage of pharmacist-interns' recommendations that were accepted by medical prescribers or patients. The outcomes were divided into outcomes related to medication-related recommendations (MRRs) and outcomes related to health-related recommendations (HRRs). Table 3.28 shows that 28.9 percent of recommendations related to OTC medications and herbal supplements were accepted. Among prescription medications, recommendations related to drug discontinued had the highest percentage of acceptance (34.8%). 13.9 percent of the HRRs, which represent recommendations related to: (1) immunizations; (2) diabetes, hypertension, and dyslipidemia care; and (3) smoking and alcohol education, were accepted (see Table 3.28).

Table 3.28 Number, Number Accepted, and Percent Accepted of Pharmacist-Interns' Medication and Health-Related Recommendation Outcomes

Type of Recommendation Outcome	Number of recommendations	Number Accepted	Percent (%) Accepted
Over-the-counter (OTC) and herbal supplements recommendations			
Over-the-counter (OTC) and herbal supplements	97	28	28.9
Prescription medication recommendations			
Drug discontinued	23	8	34.8
Dosage form changed	4	1	25.0
Schedule/duration changed	122	28	23.0
Drug changed	85	17	20.0
Drug added	44	8	18.2
Drug efficacy/safety lab monitoring accepted	119	12	10.1
Dose changed	44	3	6.8
Drug changed to over-the-counter (OTC)	2	0	0.0
Route changed	1	0	0.0
Approved refill request	1	0	0.0
Health-related recommendations			
Health-related recommendations	462	64	13.9
Overall			
Overall health-related recommendations	462	64	13.9
Overall prescription medication recommendations	542	105	19.4
Overall medication and health-related recommendations	1004	169	16.8

Tables 3.13 – 3.20 showed that students identified 935 medication-related problems (MRPs) (3.4 MRPs per patient) and 435 health-related problems (HRPs) (1.6 HRPs per patient), for a total of 1,370 medication and health-related problems (MHRPs) or 5 MHRPs per patient.

Students contacted 73 healthcare providers, counseled 162 patients/caregivers, and educated 193 patients. Moreover, students provided patients with 542 MRRs (2 MRRs per patient) and 462 HRRs (1.7 HRRs per patient), which means that overall, students provided patients with 1004 medication and health-related recommendations (MHRRs) (3.7 MHRRs per patient). The percentage of students' MRRs that were accepted was 19.4 percent and the percentage of students' HRRs that were accepted was 13.9 percent, with an overall percentage of students' MHRRs accepted was 16.8 percent.

3.5 DATA MANAGEMENT

3.5.1 Data Accuracy and Outliers

For all study variables, univariate descriptive statistics such as means, frequencies, and standard deviations were conducted. During data cleaning, keystroke errors were identified and corrected.

3.5.2 Multicollinearity

Multicollinearity is a statistical problem that occurs when independent variables are moderately to highly correlated. It might create problems in a multiple regression analysis for the following reasons: 1) decrease the R^2 (i.e., decrease the variance explained by the model); 2) confound the independent variables; and 3) increase the regression coefficient variances.[75] As a result, the variance inflation factor (VIF), which is used to evaluate the linear regression between the independent variables, is used to detect multicollinearity. Consequently, the VIF was used to examine the regression model independent variables for multicollinearity. Importantly, it has been suggested that any independent variable VIF value greater than 10 might be considered for deletion.[75] In this study, no independent

variables exceeded a VIF value greater than 3.1; as a result, all independent variables were maintained in the regression model.

3.5.3 Evaluation of Assumptions

Normality, linearity, homoscedasticity, and independency of residuals, which are the assumptions of regression, were evaluated before conducting the analysis. Univariate descriptive statistics and residual plots were used to test these assumptions. Assumption of normality was checked by examining skewness and kurtosis. Variables with skewness or kurtosis values greater than 3 or less than –3 may be considered as not normally distributed. The dependent variable, MHRPs resolved did not have any values out of range. In addition, the overall model residual plot was examined and visual inspection revealed a relatively normal distribution, linearity and no evidence of homoscedasticity or dependency among residuals.

3.6 OBJECTIVE ANALYSIS

The present study has four objectives and seven hypotheses. The first three objectives were descriptive, while multiple regression analysis was used to address the fourth objective.

Objective 1

The first objective was *to describe patients' demographic characteristics (age, gender, race), social history (smoking, alcohol and caffeine consumption), and clinical characteristics (medical conditions, prescription medications, over-the-counter (OTC) medications and herbal supplements, and number of medical prescribers)*. Section 3.2 of this chapter provided the descriptive statistics to address this objective.

Objective 2

The second objective was *to describe the number and type of medication and health-related problems (MHRPs), MTM interventions, and MTM recommendations*. Descriptive statistics were also used to address this objective (see Section 3.3).

Objective 3

The third objective was to *describe medical provider/patient MTM recommendation acceptance rates*. Descriptive statistics (see Section 3.4) were used to address this objective.

Objective 4

The fourth and final objective was *to determine what factors (baseline MHRPs, medical conditions, prescription medications, OTC medications and herbal supplements, MTM interventions, number of medical prescribers, and MTM recommendations) are related to the number of MHRPs resolved (change in MHRPs from baseline to follow-up)*. Regression analysis was employed to address this objective. Table 3.29 shows the result of the multiple regression analysis.

Table 3.29 Multiple Regression Analysis of Factors Related to MHRPs Resolved							
Variable	DF	Parameter Estimate (b)	Standard Error	Standardized Estimate (β)	T-Value	P-Value	Variance Inflation
Intercept	1	-0.015	0.26	0.000	-0.06	0.95	0.00
MHRP baseline	1	0.077	0.04	0.127	2.09	0.04*	2.87
Medical conditions	1	-0.044	0.04	-0.053	-1.14	0.25	1.67
Prescription medications	1	0.001	0.03	0.002	0.03	0.97	1.92
OTC medications and herbal supplements	1	-0.011	0.03	-0.014	-0.36	0.72	1.10
MTM interventions	1	0.138	0.09	0.060	1.59	0.11	1.10
Number of medical prescribers	1	0.032	0.06	0.020	0.49	0.62	1.32
MTM Recommendations	1	0.513	0.05	0.715	11.37	<.0001*	3.08

F statistic = 76.88; df = 7,240; Model p-value = < 0.001*; Adjusted R^2 = 0.68
*Statistically significant at $p < 0.05$.

The overall regression model was statistically significant, F=76.88, df=7, 240, p<0.001. The adjusted R^2 was 0.68, which indicated that 68 percent of the variance in the MHRPs resolved was explained by the model variables. Regarding significant factors, the number of MHRPs at baseline (β=0.127, t=2.09, p=0.04) and MTM recommendations (β =0.715, t=11.37, p<0.0001) were significantly related to the MHRPs resolved. Consequently, for every 1 point increase in MHRPs at baseline, the number of MHRPs resolved increased by 0.127. Similarly, for every 1 point increase in MTM recommendations, the number of MHRPs resolved increased by 0.715. None of the other variables were significantly related. Below are the study's hypotheses associated with this objective.

Hypothesis 1: *The number of baseline MHRPs will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **accepted** (β=0.127, *p*=0.04). The number of MHRPs at baseline was positively and significantly related to the number of the MHRPs resolved, while controlling for other factors.

Hypothesis 2: *The number of medical conditions will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **rejected** (β=–0.053, *p*=0.25). The number of medical conditions was negatively related to the number of MHRPs resolved and this relationship was not statistically significant, while controlling for other factors.

Hypothesis 3: *The number of prescription medications will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **rejected** (β=0.002, *p*=0.97). The number of medications was positively related to the number of MHRPs resolved, but this relationship was not statistically significant, while controlling for other factors.

Hypothesis 4: *The number of OTC medications and herbal supplements will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **rejected** (β=–0.014, *p*=0.72). The number of OTC medications and herbal supplements was negatively related to the number of MHRPs resolved and this relationship was not statistically significant, while controlling for other factors.

Hypothesis 5: *The number of MTM interventions will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **rejected** (β=0.060, *p*=0.11). The number of MTM interventions was positively related to the number of MHRPs resolved, but this relationship was not statistically significant, while controlling for other factors.

Hypothesis 6: *The number of medical prescribers will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **rejected** (β=0.020, *p*=0.62). The number of medical prescribers was positively related to the number of MHRPs resolved, but this relationship was not statistically significant, while controlling for other factors.

Hypothesis 7: *The number of MTM recommendations will be positively and significantly related to the number of MHRPs resolved, while controlling for other factors.*

This hypothesis was **accepted** (β=0.715, *p*<0.0001). The number of MTM recommendations was positively and significantly related to the number of the MHRPs resolved, while controlling for other factors.

CHAPTER FOUR: DISCUSSION AND CONCLUSIONS

4.1 BACKGROUND

The literature has demonstrated that pharmacist-provided MTM services improve clinical and economic outcomes for patients and the healthcare system.[5-18] However, pharmacists face barriers in providing MTM services.[24] Training programs are available to address barriers for pharmacists,[27] but training pharmacy students may be a more effective strategy for improving service provision in the future.[28,29] Several C/SOPs have realized the importance of preparing their students to provide MTM.[32,35-42]

4.2 PRESENT STUDY

This study examined the impact of third-year pharmacy students' provision of MTM to community pharmacy patients on identifying and resolving patients' medication and health related problems (MHRPs). A review of the literature revealed that studies of student-provided MTM have primarily focused on course description and students' perceptions of the course. Those that have examined MTM course outcomes have focused on increasing students' MTM knowledge and their abilities to provide MTM services,[32,35-39,41] as well as improving patients' understanding of their medications and their overall health.[34,36,37] None of the studies, however, described the clinical impact of a required 'entire' MTM course in which all students received didactic lectures, completed a training program and provided MTM services to 'real' patients in community pharmacies. The impact of requiring all students in a C/SOP to provide MTM services might differ from having a selected number of students participate. The next section discusses the study results and compares its findings with those of previous similar studies.

4.3 STUDY FINDINGS

This section highlights and compares the most salient results of the present study for each objective with those of similar studies that have previously been published. It also discusses the limitations of the present study as well as areas for future research.

4.3.1 Patients' Demographics, Social Histories, and Clinical Characteristics

Objective 1 focused on describing patient demographics, social histories, and clinical characteristics. Patients' average age was 63.8 (±14.5), which was similar the average age of patients in another MTM intervention study,[34] although it was less than the average age of patients in other studies, which ranged from 75 to 81.[32,33] Because the present study subjects were drawn from community pharmacies, they may not have been representative of Medicare patients, who are typically older. In the present study, a higher percentage of patients were female, which was similar to other studies.[5,32] This is not surprising since women tend to be more proactive regarding their health than men.[77] In the present study, the majority of patients were Caucasian (53.2%), followed by Hispanics (37.8%). Whereas, the U.S. Census Bureau reported that in 2011, Whites comprised approximately 80 percent of the U.S. and Texas population (78.1% vs. 80.9%, respectively) and Hispanics comprised 16.7% of the U.S. population and 38.1% of Texas residents.[78] Thus, the population of Hispanics were congruent with the state of Texas and Caucasians were underrepresented in the present study. Patients' social histories (i.e., caffeine, alcohol, tobacco use) are rarely addressed in student-provided MTM studies. Compared to the 2008 U.S. census, the present study population had a lower proportion of alcohol drinkers (54.8% vs. 30.7%, respectively) and smokers (23.8% vs. 12.4%, respectively).[60]

Regarding patients' clinical characteristics, the mean number of patients' medical conditions was 6, which is similar to other studies (range of 5.5-6.4).[14,32] When compared to the

Department of Health and Human Services 2010 report of patients over 65 years, [79] the present study's subjects had a higher prevalence of hypertension (68.4% (65-74 years); 80.4% (≥75 years) vs. 80.7%, respectively), dyslipidemia (51.8% vs. 67.9%, respectively), and diabetes (26.9% vs. 55.8%, respectively). Accordingly, more than half of the patients in the present study used blood pressure agents, cholesterol lowering agents, analgesic agents, and diabetic agents. Perhaps the higher prevalence could be due to the significant number of Hispanics in the study population, who are known to have disparities with these disease states.[80-82] Having all three disease states together (i.e., metabolic syndrome) is a very serious condition that can lead to additional morbidity and mortality. Pharmacist-interns or pharmacists can be very instrumental in counseling patients not only on one specific disease state, but how the combination of the three can result in poor outcomes if not managed appropriately.

The mean number of OTC medications used by patients was 2.2, which was similar to other studies (range 1.8 - 3.9).[32,34] At least one herbal supplement was used by 19 percent of patients which was similar to national estimates of 17.7 percent.[83] However, the present study may have over or underestimated herbal supplement use because pharmacist-interns sometimes miscoded herbal supplements as OTC medications (e.g., multivitamins) and vice versa. Thus, additional education regarding complementary and alternative medications (CAM), namely herbal supplements, is warranted for student pharmacists. The majority (63% to 72%) of CAM users did not disclose at least one type of CAM.[84] Therefore, educational components should include familiarity with various types of CAM used in their area, knowledge regarding potential medication-related problems, as well as strategies to encourage patients to disclose CAM use.

4.3.2 Medication and Health Related Problems (MHRPs) and Student-Pharmacists MTM Interventions and Recommendations

In the present study, MHRPs were calculated as a percent of patients (N=274), whereas, several studies in the literature calculate the frequency of problems among all MHRPs. Thus, when appropriate, comparisons will be made among all MRPs (N=935), all HRPs (N=435), and total MHRPs (N=1,370). MHRPs identified by student-pharmacists at baseline can be divided into groups depending on the type of problem. These groups were initially divided into medication-related problems (MRPs) and health-related problems (HRPs). MRPs are divided into problems related to: (1) drug product selection; (2) drug regimen; (3) precautions/interactions/contraindications; and (4) adverse effects and use. Health-related problems are divided into: (1) immunizations; (2) social histories and lifestyle issues; (3) lack of understanding drug indication and continuity of care; and (4) disease monitoring and control. The following section will highlight the most frequent problems within each group of problems and compare them with those identified in other student-provided and pharmacist-provided MTM studies.

When examining each group of MRPs (see Tables 3.13 - 3.16), problems related to precautions/interactions/contraindications and product selection had the highest overall means 1.2 (±1.6) and 1.1(±1.2), respectively. However, the lowest means for MRPs were related to drug regimens or adverse effects and use, which might indicate that pharmacist-interns had difficulty identifying these types of problems.

The most prevalent problems within the *drug product selection* group were OTC and herbal medication use, cost/formulary exchange, and duplication. Pharmacist-interns identified at least one problem related to OTC medications in 20.4 percent of patients, while Cerulli et al.

found 44 percent of patients had problems related to nonprescription medications.[34] The present study's results may have been lower because OTC and prescription drug interactions were coded as drug-drug interactions versus an OTC medication problem. OTC medications and herbal supplements may interact with prescription medications and cause serious adverse drug reactions.[85] With 81 percent of the patients using at least one product in the present study, pharmacists and pharmacist-interns have an opportunity to identify, prevent, and resolve these types of problems. Thus, they should routinely ask patients about OTC and herbal supplements that they are using and ensure appropriate use or identify an alternative. The second most prevalent problem was cost/formulary interchange (14.2%). Other pharmacist-provided MTM studies identified cost issues at higher prevalence rates (33.3% - 85%,)[7,10,12] Perhaps initial MTM interventions were successful in identifying cost savings and current MTM programs are focusing on other MRPs. However, when examining studies of student-pharmacist provided MTM, only 6.0 percent of MRPs were related to cost,[42] which is lower than the present study's findings. The difference between pharmacist and student provided MTM may be that pharmacists are more familiar with the various formulary tiered copayment structures and they can readily identify cost savings options. Increased medication costs are associated with poor medication adherence, which can lead to suboptimal health outcomes.[86] To help improve medication adherence and outcomes, pharmacists and pharmacist-interns can help patients identify less costly alternatives by using strategies such as switching to generics, using formulary medications, educating about patient assistance programs, or identifying discount coupons. In the present study, 4.4 percent of all MRPs (n=935) were related to drug duplication, which is within the range of two other studies.[34,42]

The most frequent problems among patients related to *drug regimen* were dose (14.6%) and schedule duration (14.2%). Furthermore, among all MRPs identified, the percentage of problems related to dose and schedule duration were, 4.8 percent and 5.8 percent, respectively. Other studies showed that problems related to dose ranged from 11.2 percent –24.8 percent,[14,32,34,37] and problems related to schedule duration was 14.4 percent.[37] The present study's frequency was lower than other studies, which were conducted with pharmacist-provided and student-provided MTM services. Perhaps this is an area where student pharmacists can receive additional education, or it could be reflective of the study subjects' actual problems in this area.

Regarding the type of problems related to *precautions/interactions/ contraindications*, 48.5 percent of patients had a drug interaction identified. Among all MRPs identified by pharmacist-interns, 26.7 percent were related to drug-drug interactions, which was higher than Hata et al. (14.9%).[37] This finding may have been the result of coding the interaction between OTC medications and prescription medications as drug-drug interactions instead of precautions/interactions/contraindications.

Furthermore, pharmacist-interns identified at least one problem related to drug adverse effects in 23.0 percent of patients, which accounted for 9.5 percent of all MRPs identified. Other studies also documented the problems related to drug adverse effect and found them to range from 9.0 percent - 18.2 percent of MRPs.[14,32,34,37] Due to the presence of other MRPs categories (e.g., allergy and toxicity) in the present study, which might interfere with problems related to adverse drug reactions, the current study finding is greater than other studies.

Regarding the total number of MRPs, the present study documented 935 MRPs, or an average of 3.4 MRPs per patient. This result was higher than what other student MTM studies

found (0.9 – 2.0 MRPs per patients).[34,36,37] The reason for the discrepancy could be that other studies offer the MTM course as a *part* of a course (versus the entire course), and that students were not required to complete the MTM training certificate program, "Delivering Medication Therapy Management Services in the Community."[34,36,37]

In contrast to other studies, pharmacist-interns in this study identified problems with *immunizations*. This could be the result of the requirement to complete an immunization certificate program before registering for the course. Importantly, pharmacist-interns found that 54 percent of patients were up-to-date on immunizations. This finding should be viewed with caution because it is possible that patients' recall may have been unreliable. C/SOPs should offer training programs for students to become immunizers. Pharmacists and pharmacist-interns can play a significant role in ensuring that patients receive needed vaccinations. They can also educate patients on the individual and public health benefits of vaccines. Regarding lifestyle issues, over 10 percent of the patients were identified as having poor diet (14.2%), obesity (13.9%) and lack of exercise (11.0%), which may be linked to the high prevalence of hypertension, diabetes, and dyslipidemia in the study population. This highlights the importance of not only educating patients about their medications, but also making sure they understand how lifestyle issues can impact their outcomes.

Once pharmacist-interns identified MHRPs, the next step was to intervene with the patient or their providers by pharmacist-interns contacting physicians, patients contacting physicians, educating patients, counseling patients/caregivers, and referring patients. Pharmacist-interns contacted about one-fourth (26.6%) of patients' physicians. This result is lower than one study related to MTM in which only 51.5 percent of physicians reported that they never really had contact with pharmacists regarding patients' medications.[20] More frequently, pharmacist-

interns asked patients to contact their physicians (29.2%). Getting patients more involved and encouraging them to have more ownership of their healthcare is also important in MTM provision.[63] Time constraints within the pharmacy may also have been a reason for this finding. The present study defined patient/caregiver counseling (59%) as any intervention that included providing patients or their caregivers with verbal or written instructions on taking their medications, while education (70.4%) was defined as any intervention that included providing the patients with verbal or written instructions on overall health. Because this study classified these interventions differently than other studies, comparisons could not be made. Referrals were made to approximately 40 percent of patients' providers; however, documentation regarding to whom (e.g., primary care, specialist, dieticians, and behavioral counseling) was not well documented. Pharmacists and pharmacist-interns should be more detailed when documenting interventions so that timely and appropriate follow up can occur.

Next are the pharmacist-interns' recommendations related to MHRPs. Recommendations related to drug efficacy/safety lab monitoring (29.9%) and recommendations related to changing medications schedule/duration (29.6%) occurred more frequently than other recommendations related to medications. The number of recommendations related to drug efficacy/safety lab monitoring was high because combining these individual problems (i.e., problems related to: (1) drug safety and (2) drug efficacy) resulted in a frequency of 25.2 percent. The number of recommendations related to changing medications schedule/duration was high because these occurred when patients had problems related to drug schedule/duration, drug-drug interaction, or drug-food interaction (combined frequency = 67.8%). Drug and food interactions problems were included in these recommendations because they involved changing the drug schedule. For example, if two drugs were taken together and interacted, the recommendation may have been to

take one in the morning and the other at bedtime. Of the medication-related recommendations (MRRs), 15.7 percent were related to changing medications, whereas Donihi et al. found that 18.5 percent of students' MRRs were related to changing medications.[41] The lowest number of recommendations was related to changing the route of drug administration.[41] Because MTM was provided in community pharmacies, recommendations related to changing the route of medication (e.g., from oral to intravenous) were likely to be infrequent. The number of recommendations related to immunizations indicated that pharmacist-interns did not recommend that all patients who needed them receive their vaccines. For example, 111 patients mentioned that they did not receive their influenza vaccine, but only 78 of those patients were recommended to receive it. Similarly, the number of recommendations regarding smoking and alcohol consumption indicated that pharmacist-interns did not recommend that all patients who were smokers (n=33) quit smoking or that all patients who drank alcohol (n=82) stop, if contraindicated, or decrease alcohol consumption, if warranted.

4.3.3 MTM Outcome

This study's MTM outcomes represent the pharmacist-interns' MTM recommendations that were accepted by either medical prescribers or patients. Of the pharmacist-interns' recommendations related to OTC medications, 28 percent were accepted. 'Drug discontinuation,' followed by 'change of dosage form' were the recommendations with the highest rates of acceptance, whereas recommendations related to change of drug were the least accepted. Overall, 19.4 percent of the medication-related recommendations (MRRs) were accepted by either medical prescribers or patients. This percentage of acceptance is lower than what was found in the literature (52.6% – 86%). [34,41,42] Three issues that may have contributed to the low acceptance rate of recommendations in the present study were the inclusion of community

pharmacy patients, who may not have had established primary care homes; thus making follow-up with providers difficult. A second reason was lack of time for follow up. Pharmacist-interns were working in the pharmacy setting for short periods of time, which may have precluded appropriate follow-up. A third reason is that the MHRPs may not have been a problem. For example, a patient may have been identified as having duplicate therapy. However, if the provider confirms that the therapy is needed, the recommendation to discontinue a therapy was not accepted. Finally, 13.9 percent of pharmacist-interns' recommendations related to preventive care were accepted. This category included recommendations related to preventive care, immunization, diabetes, hypertension, dyslipidemia, and education. This number, although it is lower than the findings of a pharmacist-provided MTM study (44.3%)[74], shows that there is room for improvement in getting patients to be more proactive regarding their health. Patients may need conditional follow-up and reminders to make behavior change. Teaching students motivational interviewing may be a strategy to help patients make this change.

4.3.4 Number of Medication and Health Related Problems (MHRPS) Resolved

Examining the factors that are associated with the number of medication and health related problems (MHRPs) resolved was the fourth objective of this study. Factors that were assumed to predict the resolution of MHRPs were as follows: Number of MHRPs at baseline, medical conditions, medications, OTC medications and herbal supplements, MTM interventions, number of medical prescribers, and MTM recommendations. This study hypothesized that those predictor variables (independent variables) would positively correlate with the number of MHRPs resolved. One study showed that patients who have a high number of medications and/or a high number of medical conditions have a high number of MHRPs,[87] which would theoretically lead to a high number of MHRPs resolved. Likewise, patients who have a high

number of prescribers tend to have more MHRPs.[88] The present study's overall multiple regression model was statistically significant ($F = 76.88$, $df=7, 240$, $p <0.001$). Among regression model predictors, the number of MHRPs at baseline and the number of MTM recommendations were significantly and positively correlated with the number of MHRPs resolved. It is not surprising that patients who present with multiple problems will have a higher frequency of problem resolution. However, the positive relationship between number of recommendations and MHRPs resolution may indicate that pharmacists and pharmacist-interns should not be hesitant to make recommendations and that they should follow up with healthcare providers once the recommendation has been made.

4.4 STUDY LIMITATIONS

The present study has several limitations. First, patients who received MTM services were referred either from Mirixa®, OutcomesMTM®, assisted living facility centers, or were patients who were interested in receiving the MTM services. These patients might not be considered eligible under Medicare's Part D MTM program eligibility criteria.[4] However, because the average age of study's patients was 63.8, 93.9 percent had more than one medical condition, 95.3 percent had more than three prescriptions medications, and the patients had many MHRPs, those 65 years and older might be eligible under the Part D program. Next, because of patient self-reports, the accuracy of information, such as the acceptance of MTM recommendations, is uncertain. Furthermore, in some cases, two pharmacist-interns were asked to provide MTM services to same patient. In this situation, pharmacist-interns would interview a patient at the initial visit to collect his or her information, and then they were asked to work individually on identifying the patient's MHRPs, and then provide him or her with one set of recommendations. Because the pharmacist-interns were encountering the patient together, their MTM provision

should be identical, but this was not always the case. To control for this, the present study combined documentation for the patient cases. As with any "chart review" study, the data is only as accurate as the accuracy and completeness of the documentation. In addition, students documented their findings and recommendations in a written format. Thus interpretation of problems, interventions, and recommendations were at the discretion of the researcher and could have been biased or misrepresented.

4.5 STUDY CONCLUSION

Third-year pharmacy students, after completing an MTM certificate training program and listening to MTM lectures, provided MTM services for patients in community pharmacies. Students had an impact on patients' medication and health related outcomes. Adult patients (N=274) with multiple medications and medical conditions received MTM services and 1,370 MHRPs were identified and 1004 MHRRs were provided. The most prevalent problem was related to precautions/interactions/contraindications, and the most frequently provided recommendation was related to change in medication schedule and duration of medication use. Although the overall acceptance rate was 16.8 percent, students were unable to continue follow up with medical providers/patients due to limited timespan of the class. MHRPs baseline and MTM recommendation were positively and significantly related to the number of MHRPs resolved.

Future research needs to estimate the economic, in addition to the clinical impact of intern pharmacists' MTM service provision for individual patients the health care system overall. For example, estimating the direct and indirect cost avoidance as a result of pharmacy students providing MTM services is important. Estimating the impact of this type of MTM service on helping the elderly and low-income patients avoid clinical and economic burdens is particularly

important. Also, measuring how MTM provided by students or pharmacists can help Medicare patients who are in the "donut hole" will be beneficial.

Regarding the MTM course, it is important to continue following up with medical providers and patients regarding students' recommendations. Also, preparing the students to effectively document their provision of MTM will help to accurately detect their impact. Furthermore, providing students with a detailed list of MHRPs might help them in documenting their services, which in turn would help in estimating their impact. In addition, measuring the students' intention to provide MTM services and their therapeutic skills before and after providing MTM services would be a useful way to estimate the impact of MTM courses on patients and students alike. The UT-COP Clinical Skills: Community Care was instrumental in identifying 3.4 MRPs and 1.6 HRPs per patient in a community pharmacy setting. Although the overall acceptance rate (16.8%) was low, it is likely that continual follow up and improved documentation may lead to more positive changes in patients' MHRPs and their health-related outcomes.

Appendix A1

Clinical Skills: Community Care Course Syllabus 2010 (Pilot)

Clinical Skills: Community Care Course Syllabus (Pilot Course)

PHR 261J - Clinical Skills: Community Care
Unique #59476
Fall 2010
Course Coordinator: Sharon Rush, R.Ph.
PHR 2.222G, 232-3463
sharon.rush@austin.utexas.edu
Office hours by appointment
Course Administrative Coordinator: Sherrie Bendele
PHR 5.110, 232-2630
s.bendele@austin.utexas.edu

Course Objectives:

- To provide P3 student-interns with an activity-based Intermediate Pharmacy Practice Experience in a community/ambulatory care pharmacy practice setting
- To integrate basic clinical and scientific knowledge in the care of ambulatory patients in actual practice settings
- To train student-interns to perform Medication Therapy Management
- To better prepare student-interns for Advanced Pharmacy Practice Experiences in the P4 year
- To develop a better understanding of the profession of pharmacy from a community pharmacy perspective
- Student-interns will be able to demonstrate the following:
    - Basic understanding of:
        - Medication Therapy Management
        - Public Health
        - Patient Safety
        - Other experiences that may involve Drug Utilization Review, Drug Information, Immunizations or Health Screenings

General Course Description:

Prior to the P3 year, student-interns will be distributed to four campuses: UT Austin, UTHSCSA, UTEP and UTPA. Within these geographic areas, student-interns will be assigned to a preceptor and a P4 student mentor and will participate in community/ambulatory care-specific activities. Flexibility to accommodate the student-intern's class and lab schedule, preceptor availability and patient load will be observed. Student-interns will complete 80 hours over the course of the semester at approximately 4 to 5 hours per week. During this time, student-interns are required to participate in the following:

- Activities associated with *Medication Therapy Management (MTM) in Pharmacy Practice: Core Elements of an MTM Service Version 2.0.* These activities include

medication therapy review, development of personal medication records and medication-related action plans, intervention and referral, documentation and follow-up. Student-interns will accomplish this by participating in the following:

  - Completion of APhA's *Delivering Medication Therapy Management Services in the Community* national certificate training program
  - Completion of five Comprehensive Medication Review MTM (CMR MTM) cases that must be turned in to the Course Coordinator

- Public health promotion through the development of a health and wellness-related project as determined by the practice site and student. For this course, public health is defined as anything that affects the health and wellbeing of a patient, such as disease prevention, immunizations, health screenings, etc.
- Patient safety exercise -For this course, patient safety is defined as any aspect of the prescription process that may affect the accurate delivery and administration of a medication. This process follows the prescription from the prescribing physician to the actual use by the patient. The patient safety exercise includes:
  - The completion of one of the following:
    - Health Literacy Assessment. Refer to AHRQ Pharmacy Health Literacy Center at http://pharmacyhealthliteracy.ahrq.gov/sites/PharmHealthLiteracy/default.aspx. **–OR--**
    - Medication Safety Self Assessment at http://www.ismp.org/selfassessments/Book.pdf.
  - County census search at http://2010.census.gov →Data Tools at bottom of page →Interactive Internet Tools → Censtats →USA Counties Data →Select state and county. Pick "General Profile" and hit "Go".
  - Completion of one Medication Calendar for an MTM patient.
- Reflections on experiences will be required at designated times. These reflections give the student-intern an opportunity to think about what they have learned and examine the procedures used in completing each exercise. It is strongly encouraged to write the reflection immediately upon completion of the exercise while it is still fresh in the student-intern's mind. It is also strongly recommended that reflection notes are written on a weekly basis to keep track of highlights and thoughts that occur. Reflections need to be one to two pages in length.
- Additionally, student-interns are required to participate in a minimum of one of the following activities to build upon previous learning and skill development:
  - Promotion of immunizations through patient education and assessment or administration of vaccines if the student is a certified immunizer.
  - Demonstration of patient assessment skills through health screenings, etc.
  - Drug Utilization Review
  - Drug Information request

NOTE: Prescription dispensing activities should comprise less than 5% of student-intern's time

Course Literature:

- Required:
  - *"Delivering Medication Therapy Management Services in the Community"* certification course booklet
  - *"Medication Therapy Management in Pharmacy Practice: Core Elements of an MTM Service Model"* – Version 2.0, March 2008, APhA website at www.pharmacist.com
  - *"Motivational Interviewing"* - APhA CE at www.pharmacist.com
- Suggested:
  - *"Medication Therapy Management Services: Creating a Patient Care Process for MTM in Your Practice"* – Module 4, APhA CE 2007 at www.pharmacist.com
  - *"Why Pharmacists Belong in The Medical Home"* – Marie Smith, David W. Bates, Thomas Bodenheimer, and Paul D. Cleary. Health Affairs, May 2010, 29:5
  - *Medication Safety Self-Assessment for Community/Ambulatory Pharmacy* – http://www.ismp.org/selfassessments/Book.pdf

Documentation Forms:

Experience Form	**Where to locate form**	**Where to submit form**
Medication Therapy Management • Medication Therapy Review (MTR) • Personal Medication Record (PMR) • Medication-Related Action Plan (MAP) • Intervention and/or Referral • APhA Statement of Completion • Reflection	• Statement of Completion in MTM workbook • All other MTM forms found on Blackboard • Reflection found on Blackboard	• Statement of Completion to Sherrie Bendele • All other MTM forms are submitted on Blackboard. Keep copies in your notebook. • Reflection form is submitted on Blackboard.
Experience Form	**Where to locate form**	**Where to submit form**
Public Health • Outline • Reflection	• Outline is student-intern's own format.	• Show outline to preceptor and keep in notebook

	• Reflection found on Blackboard	• Reflection form is submitted on Blackboard
Patient Safety • Health Literacy • Patient Safety • Census Search • Medication Calendar • Reflection	• Health Literacy, Patient Safety and Census Search found on Blackboard and indicated websites • Medication calendar and Reflection found on Blackboard	• Health Literacy, Patient Safety and Census Search are shown to preceptor and kept in notebook • Medication Calendar and Reflection are submitted on Blackboard
Drug Information and Drug Utilization Review • Documentation forms • Reflection	• Blackboard	• Documentation forms – show to preceptor and keep in notebook • Reflection submitted on Blackboard
Health Screenings and Immunizations • Reflection	• Blackboard	• Blackboard

Course Grade:
This is a 2-hour experience-based course graded "Credit/Fail". To receive credit for this course, the student-intern must satisfactorily complete all course requirements. Failure to successfully complete any of the following course requirements will result in automatic failure of the entire course:

- Completion of 80 experiential hours
- Completion of APhA's *Delivering Medication Therapy Management Services in the Community* certification course and all required activities and documentation
  - Completion and documentation of five CMR MTM cases
- Completion of Public Health project and all required activities and documentation
- Completion of Patient Safety Assessment and all required activities and documentation
- Completion of a minimum of one elective experience and all required activities and documentation
- Reflections
  - MTM case

- Public Health project
- Patient Safety exercise
- Elective exercise

Timeline:
Deadlines for required documentation are on the timeline which is the last page of the syllabus. All required documentation for the week must be submitted by 5pm that Friday.

Schedules:
Schedules will be determined by student-intern and site preceptor. The number of hours scheduled each week may vary depending on the student-intern, the preceptor and the practice site's activities. All efforts will be made to accommodate the schedules of involved entities. Weekend and evening hours may be necessary to fulfill all course requirements, i.e. Saturday screenings, immunization clinics, etc. Schedules for the following month need to be determined by the 22nd day of the month. A week's notice is required for any changes to the schedule and must be approved by the student-intern and site preceptor. It is required that student-interns be present on all days of the scheduled rotation period. Regular and prompt attendance mimics the actual working world. Holidays may be observed by the student-intern provided the preceptor approves. Religious holidays may be observed according to University policy. The student-intern must make up the hours missed during this time.

The student-intern's time should be divided up as follows:

- Medication Therapy Management - ~70%
- Public Health - ~10%
- Patient Safety - ~10%
- Elective Experience - ~10%

These are approximations and may vary slightly between sites.

Hours Sheet:
The Hours Sheet is designed to keep track of all hours worked each week plus any scheduled required documentation. It is the student-intern's responsibility to ensure this sheet is complete, accurate and current. All entries need to be completed in ink. At the end of the shift, the student-intern or preceptor must record the shift and hours completed and review any required documentation for that week. ***If a preceptor feels that there is reason to believe that a student-intern may be misrepresenting his or her hours as recorded on the hour sheet, the Course Coordinator should be notified immediately. This type of behavior constitutes academic dishonesty and will not be tolerated. The penalty for falsification of hours is failure of the course.***

Standards of Conduct:

- Student-interns are required to abide by the facility's Health Information Portability and Accountability Act (HIPAA) policies. You may be required to sign a temporary HIPAA form at your site.

- Student-interns must abide by all laws and regulations pertaining to a student-intern as defined by the Texas Pharmacy Act and Rules. Violation of these laws and regulations may jeopardize the intern's privilege to become a registered pharmacist in Texas and may also result in failure of the course and dismissal from the College and/or the University.
- Student-interns will be removed from a practice site for conduct deemed unprofessional by the preceptor and/or Student Affairs Office, or if the student-intern's actions endanger a patient's health or welfare. Removal from a practice site may result in failure of the course.
- Professional demeanor and dress are expected and required throughout the course. The student-intern is representing the University of Texas College of Pharmacy and is expected to behave accordingly.

General Requirements:

- Completion of the following UT Compliance Modules:
    - Bloodborne Pathogens at

https://utdirect.utexas.edu/cts/class.WBX?s_course_comp=0&s_course_prefix=CW&s_course_number=0533

    - General HIPAA Privacy at

https://utdirect.utexas.edu/cts/class>WBX?s_course_comp=0&s_course_prefix=CW&s_course_number=0500

    - Log into both of the websites above, or alternatively https://utdirect.utexas.edu/cts/index.WBX and click on Compliance Training
    - Complete BOTH courses and take the quiz at the end of each course
    - You may be prompted or have the option to print a certification of completion. Please print these for your records. We verify your participation in another way.
- Student-interns need to provide a binder to keep all records and documentation.
- E-Mail – Student-interns are required to be accessible via e-mail and to check e-mail at a minimum of two times weekly per University policy. Additionally, it is mandatory that students communicate any changes in e-mail or regular mail addresses to the Office of Student Affairs and the Course Coordinator immediately.
- Transportation – The student-intern is responsible for his/her own transportation to and from any assigned practice site or class activity. Prompt arrival is expected.
- Dress Code - UT student-intern name badges, business casual dress and white jackets are to be worn at all times while fulfilling the course objectives. Blue jeans and open-toed shoes are unacceptable dress even if the practice site allows it. The Texas State Board of Pharmacy requires you to have your intern card in your possession at all times.
- Cell phones are not to be used during the hours at your site.

Appendix A2

Clinical Skills: Community Care Course Syllabus Fall 2011

Clinical Skills: Community Care Course Syllabus

PHR 287H - Clinical Skills: Community Care
Unique #59965, 59975, 59980, 60000, 60005, 60010, 60015, 60020, 60025
Fall 2011
Course Coordinator: Sharon Rush, R.Ph.
PHR 2.222G, 232-3463
sharon.rush@austin.utexas.edu
Office hours by appointment
Course Administrative Coordinator: Sherrie Bendele
PHR 5.110, 232-2630
s.bendele@austin.utexas.edu
Office hours by appointment

Course Goals:

- The Community Introductory Pharmacy Practice Experience (IPPE) is an activity-based experience in a community/ambulatory care pharmacy practice setting designed to help pharmacist-interns develop a better understanding of the profession of pharmacy from a community pharmacy perspective. This experience will better prepare pharmacist-interns for their Advanced Pharmacy Practice Experience.

Course Objectives:

- Pharmacist-interns will be able to integrate basic clinical and scientific knowledge in the care of ambulatory patients in actual practice settings through the performance of Medication Therapy Management
- Pharmacist-interns will review patient medication histories and develop action plans to optimize a patient's medication therapy and outcomes
- Educate patients on health and wellness through the development and execution of a public health project
- Assess patient safety by performing drug utilization reviews and drug information requests
- Demonstrate longitudinal learning through continued application of patient assessment and immunizations

Course Requirements:

Prerequisites: Completion of the second professional year in the College of Pharmacy. Prior to the P3 year, pharmacist-interns will be distributed to four campuses: UT Austin, UTHSCSA, UTEP and UTPA. Within these geographic areas, pharmacist-interns will be assigned to a preceptor and will participate in community/ambulatory care-specific activities. Flexibility to accommodate the pharmacist-intern's class and lab schedule, preceptor availability and patient load will be observed. Pharmacist-interns will complete

80 hours over the course of the semester at approximately 4 to 6 hours per week. During this time, pharmacist-interns are required to participate in the following:

- Activities associated with *Medication Therapy Management (MTM) in Pharmacy Practice: Core Elements of an MTM Service Version 2.0.* These activities include medication therapy review, development of personal medication records and medication-related action plans, intervention and referral, documentation and follow-up. Pharmacist-interns will accomplish this by participating in the following:
    - Completion of APhA's *Delivering Medication Therapy Management Services in the Community* national certificate training program
    - Completion of five Comprehensive Medication Review MTM (CMR MTM) cases that must be turned in to the Course Coordinator
- Public health promotion through the development of a health and wellness-related project as determined by the practice site and pharmacist-intern. For this course, public health is defined as anything that affects the health and wellbeing of a patient, such as disease prevention, immunizations, health screenings, etc.
- Patient safety exercise - For this course, patient safety is defined as any aspect of the prescription process that may affect the accurate delivery and administration of a medication. This process follows the prescription from the prescribing physician to the actual use by the patient. The patient safety exercise includes:
    - Completion of one Drug Utilization Review
    - Completion of one Drug Information Request
    - Completion of one Medication Calendar for an MTM patient.
- Reflections on experiences will be required at designated times. These reflections give the pharmacist-interns an opportunity to think about what they have learned and examine the procedures used in completing each exercise. It is strongly encouraged to write the reflection immediately upon completion of the exercise while it is still fresh in the pharmacist-intern's mind. It is also strongly recommended that reflection notes are written on a weekly basis to keep track of highlights and thoughts that occur. Reflections need to be one to two pages in length.
- Pharmacist-interns will participate in a minimum of two of the following elective activities to build upon previous learning and skill development:
    - Administration of immunizations
    - Demonstration of patient assessment skills through health screenings, etc.
    - Other activities assigned by preceptor

NOTE: Prescription dispensing activities should comprise less than 5% of the pharmacist-intern's time.

Course Literature:

Required:

- *"Delivering Medication Therapy Management Services in the Community"* certification course booklet
- *"Medication Therapy Management in Pharmacy Practice: Core Elements of an MTM Service Model"* – Version 2.0, March 2008 at http://www.accp.com/docs/positions/misc/CoreElements.pdf
  - Various handouts on Motivational Interviewing:
    - Mirixa tip sheet – in IPPE binder packet
    - An overview of Motivational Interviewing at http://www.motivationalinterview.org/Documents/1%20A%20MI%20Definition%20Principles%20&%20Approach%20V4%20012911.pdf
    - Handout #1 – Getting to Change and Ten Strategies at http://www.motivationalinterview.org/clinicians/Side_bar/skills_maintenence.html

Suggested:

- *"Medication Therapy Management Services: Creating a Patient Care Process for MTM in Your Practice"* – Module 4, APhA CE 2007 at http://www.pharmacist.com/AM/Template.cfm?Section=Home2&TEMPLATE=/CM/ContentDisplay.cfm&CONTENTID=19018
- *"Why Pharmacists Belong in The Medical Home"* – Marie Smith, David W. Bates, Thomas Bodenheimer, and Paul D. Cleary. Health Affairs, May 2010, 29:5 at http://www.cshp.org/uploads/file/Newsroom/2010/why_pharmacists_belong_in_med_home_5_2010.pdf
- *Medication Safety Self-Assessment for Community/Ambulatory Pharmacy* – http://www.ismp.org/selfassessments/Book.pdf

Documentation:

This course utilizes Blackboard for communication, distribution of course materials and documents, and to submit assignments. Blackboard is a web-based course management system with password-protected access at http://courses.utexas.edu. You can find support for using Blackboard at the ITS Help Desk at 512-475-9400 Monday through Friday, 8am to 6pm Central Time.

Documentation Forms:

Experience Form	Where to locate form	Where to submit form
Medication Therapy Management • Medication Therapy Review (MTR) • Pharmacist Action Plan • Personal Medication Record • APhA Statement of Completion • MTM Mini-Reflection • Self-study test from MTM booklet • Pre-case workup from MTM booklet • Reflection	• Statement of Completion, self-study test and MTM Pre-case in MTM workbook • MTM Mini-Reflection in IPPE binder packet • All other MTM forms found on Blackboard • Reflection found on Blackboard	• Statement of Completion, self-study test, MTM Pre-case and MTM Mini-Reflection to Sherrie Bendele • All other MTM forms are submitted on Blackboard. Keep copies in your notebook. • Reflection form is submitted on Blackboard.
Public Health • Outline • Reflection	• Outline is student-intern's own format. • Reflection found on Blackboard	• Show outline to preceptor and keep in notebook • Reflection form is submitted on Blackboard
Patient Safety • Drug Utilization Review (DUR) • Drug Information Request (DI) • Medication Calendar • Reflection	• Patient Safety Documentation form for DUR and DI found on Blackboard • Medication calendar and Reflection found on Blackboard	• Patient Safety Documentation form submitted on Blackboard – one each for DUR and DI • Medication Calendar and Reflection are submitted on Blackboard
Electives • Reflection	• Blackboard	• Blackboard

Course Grade:
This is a 2-hour experience-based course graded "Credit/Fail". To receive credit for this course, the pharmacist-intern must satisfactorily complete all course requirements. Failure to successfully complete any of the following course requirements will result in automatic failure of the entire course:

- Completion of 80 experiential hours
- Completion of APhA's *Delivering Medication Therapy Management Services in the Community* certification course plus all required activities and documentation. Attendance at this course is required – no exceptions. Failure to attend this course results in automatic failure of the course.
    - Successful completion of the self-study test
    - Successful completion of the pre-case workup
    - Completion and documentation of five CMR MTM cases
    - Statement of Completion
- Completion of Public Health Project plus all required activities and documentation
- Completion of Patient Safety exercises plus all required activities and documentation
    - Drug Utilization Review
    - Drug Information request
    - Medication Calendar
- Completion of a minimum of two elective experiences plus all required activities and documentation
- Reflections
    - MTM case
    - Public Health project
    - Patient Safety exercise
    - Elective exercise
- Intern Evaluation Form
    - Must NOT receive 3 or more "2" ratings on the end of rotation evaluation
    - Must NOT receive a "1" rating on the end of rotation evaluation
    - A mid-rotation evaluation should be recorded on the pharmacist-intern's evaluation form. The practitioner-faculty member should discuss the pharmacist-intern's overall performance with him/her, pointing out strengths and areas where improvement can be made. Any indication that the pharmacist-intern may fail the course needs to be reported to the course coordinator as soon as possible.
- Professional points – If the pharmacist-intern receives a deduction of 15 or more professional points during the course, he/she automatically fails the course. The points are determined as follows:
    - Unscheduled absence – 10 points

- 15 minutes late for a shift – 3 points
- No professional business casual attire, lab coat or UT name badge worn during your assigned shifts – 1 point
- Designated deadlines on course timeline – 1 point for each day past deadline. These include the following:
  - All MTM cases – three separate deadlines throughout the course
  - Statement of Completion
  - All reflections
  - Medication Calendar

- Failure of the course: If a pharmacist-intern fails this course, the course must be repeated. A delay in graduation is automatically implied since the course takes place over an entire semester and is only available during the fall and spring semesters.

Timeline:
Deadlines for required documentation are on the timeline which is the last page of the syllabus. All required documentation for the week must be submitted by 5pm that Friday.

Schedules:
Schedules will be determined by the pharmacist-intern and site preceptor. The number of hours scheduled each week may vary depending on the pharmacist-intern, the preceptor and the practice site's activities. All efforts will be made to accommodate the schedules of involved entities. Weekend and evening hours may be necessary to fulfill all course requirements, i.e. Saturday screenings, immunization clinics, etc. Schedules for the following month need to be determined by the 22nd day of the month. A week's notice is required for any changes to the schedule and must be approved by the pharmacist-intern and site preceptor. This notice must be done in the preferred form of the preceptor and may include email, phone call or other methods. It is required that pharmacist-interns be present on all days of the scheduled rotation period. Regular and prompt attendance mimics the actual working world. If you are unable to make your assigned shift at the last minute due to illness or other **unforeseen** circumstances, you must call the practice site as soon as you know you are unable to make your shift. Failure to do so may result in a deduction of 10 professional points. Studying for exams, double scheduling events during your assigned shifts, etc. are not considered unforeseen circumstances. Holidays may be observed by the pharmacist-intern provided the preceptor approves. Religious holidays may be observed according to University policy. The pharmacist-intern must make up the hours missed during this time.

The pharmacist-intern's time should be divided up as follows:
- Medication Therapy Management - ~70%
- Public Health - ~15%
- Patient Safety - ~5%
- Elective Experience - ~10%

These are approximations and may vary slightly between sites.

Hours Sheet:
The Hours Sheet is designed to keep track of all hours worked each week plus any scheduled required documentation. It is the pharmacist-intern's responsibility to ensure this sheet is complete, accurate and current. All entries need to be completed in ink. At the end of the shift, the pharmacist-intern or preceptor must record the shift and hours completed and review any required documentation for that week. ***If a preceptor feels that there is reason to believe that a pharmacist-intern may be misrepresenting his/her hours as recorded on the hour sheet, the Course Coordinator should be notified immediately. This type of behavior constitutes academic dishonesty and will not be tolerated. The penalty for falsification of hours is failure of the course.***

Standards of Conduct:

- Pharmacist-interns are required to abide by the facility's Health Information Portability and Accountability Act (HIPAA) policies. You may be required to sign a temporary HIPAA form at your site.
- Pharmacist-interns must abide by all laws and regulations pertaining to a pharmacist-intern as defined by the Texas Pharmacy Act and Rules. Violation of these laws and regulations may jeopardize the pharmacist-intern's privilege to become a registered pharmacist in Texas and may also result in failure of the course and dismissal from the College and/or the University.
- Pharmacist-interns will be removed from a practice site for conduct deemed unprofessional by the preceptor and/or Student Affairs Office, or if the pharmacist-intern's actions endanger a patient's health or welfare. Removal from a practice site may result in failure of the course. The core values of the University of Texas are learning, discovery, freedom, leadership, individual opportunity and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness and respect towards peers and the community.
- Professional demeanor and dress are expected and required throughout the course. The pharmacist-intern is representing the University of Texas College of Pharmacy and is expected to behave accordingly.
- Honor code – You are expected to follow the University of Texas College of Pharmacy honor code during this course. The complete honor code can be found at http://www.utexas.edu/pharmacy/students/handbook98/3code.html

General Requirements:

- Pharmacist-interns need to provide a binder to keep all records and documentation.
- E-Mail – Email is recognized as an official mode of university correspondence; therefore, you are responsible for reading your email for university and course-related information and announcements. You are responsible for keeping the

university informed about changes to your email address. You should check your email regularly and frequently. Daily checking is recommended, but should be a minimum of twice weekly to stay current with university and course-related communications, some of which may be time-critical. You can find UT Austin's policies and instructions for updating your email address at http://www.utexas.edu/its/help/utmail/1564.

- Transportation – The pharmacist-intern is responsible for his/her own transportation to and from any assigned practice site or class activity. Prompt arrival is expected**.**
- Dress Code - UT pharmacist-intern name badges, business casual dress and white jackets are to be worn at all times while fulfilling the course objectives. Blue jeans and open-toed shoes are unacceptable dress even if the practice site allows it. The Texas State Board of Pharmacy requires you to have your intern card in your possession at all times.
- Cell phones are not to be used during the hours at your site.
- Students with disabilities may request appropriate academic accommodations from the Division of Diversity and Community Engagement, Services for Students with Disabilities at 512-471-6259 (voice) or 512-232-2937 (video phone) or www.utexas.edu/diversity/ddce/ssd.

PHR 287H Timeline – Fall 2011
Note: Spring 2012 timeline will be handed out at the end of the Fall 2011 semester. The MTM workshop will be conducted in early November.

WEEK	ACTIVITY	COMPLETED
Week One 8/20 – 8/28	• MTM Workshop – 8 hours • Orientation – 4 hours • Self-study test, MTM Pre-case and MTM Mini-Reflection due	
Week Two 8/29 – 9/4	• Hours worked at rotation site • Complete Start of Rotation self-evaluation	
Week Three 9/5 – 9/11	• Hours worked at rotation site	
Week Four 9/12 – 9/18	• Hours worked at rotation site	
Week Five 9/19 – 9/25	• Hours worked at rotation site	
Week Six 9/26 – 10/2	• Hours worked at rotation site • Public Health outline due – Show preceptor	
Week Seven 10/3 – 10/9	• Hours worked at rotation site	
Week Eight 10/10 – 10/16	• Hours worked at rotation site • Two CMR MTM cases due • Mid-rotation evaluation due	
Week Nine 10/17 – 10/23	• Hours worked at rotation site • MTM reflection due	
Week Ten 10/24 – 10/30	• Hours worked at rotation site • All Patient Safety exercises and reflection due	
Week Eleven 10/31 – 11/6	• Hours worked at rotation site	
Week Twelve 11/7 – 11/13	• Hours worked at rotation site • Two CMR MTM cases due • Elective reflection due	
Week Thirteen 11/14 – 11/20	• Hours worked at rotation site • Public Health reflection due	
Week Fourteen 11/21 – 11/27	• Hours worked at rotation site • One CMR MTM case due • APhA Statement of Completion due	
Week Fifteen 11/28- 12/2	• Hours sheet and End-of-rotation evaluation due • Feedback survey	

Appendix A3

Students' MTM Forms

Medication Therapy Review

This review is based on the information available to the pharmacist as provided by the patient. The MTR is to remain in the patient's chart in the pharmacy and can be used as a reference when communicating with other healthcare providers.

Patient Identifier:	Date of Birth:	Race:	Sex: M / F
Pharmacist/Student Intern:	Date Prepared:	Patient Height:	Patient Weight:
Type of MTM visit: Comprehensive Review ◯ Targeted Visit ◯		Blood Pressure:	Blood Glucose:
Primary Pharmacy and Phone Number:			
What questions does the patient have about his/her medications or disease states?			

Does the patient smoke or use tobacco products? Y / N	If so, what type?
For how long?	How much per day?
Does the patient drink alcoholic beverages? Y / N	If so, what type and how often?
Does the patient drink caffeinated beverages? Y / N	If so, what type and how often?
Medication Allergies and Adverse Drug Reactions (if known):	

Medical Conditions (Check all that apply):				
Alcoholism	Breastfeeding	Depression	Heart failure	Obesity
Angina	Cancer	Diabetes	High cholesterol	Osteoporosis
Arthritis	Chronic headache	GI disorder	Hypertension	Pregnancy
Asthma	Chronic pain	Glaucoma	Kidney disease	Seizure disorder
Bleeding disorder	COPD	Heart disease	Liver disease	Thyroid disease
Other:				

Medication Therapy Review					
Patient Identifier:			**Date of Birth:**		
Pharmacist/Student Intern:			**Date Prepared:**		
Prescription Medications:					
Medication Name	**Dose**	**Directions**	**Indication**	**Physician**	**Comments**
Over-the-Counter Medications:					
Herbal Supplements:					

Immunizations:	Influenza Y / N	Pneumococcal Y / N	Tdap Y / N
Meningococcal Y /N	Zostavax/Shingles Y / N	Hepatitis A Y / N	Hepatitis B Y / N

My Medication Record					
Patient Identifier:			Date of Birth:		
Pharmacist/Student Intern:			Date Prepared:		
Medication		Take For	Physician	When Do I Take It?	Special Instructions
Name	Dose				

Always carry your medication record with you and show it to all your doctors, pharmacists and other healthcare providers. Include all of your medications on this record: prescription, non-prescription (OTC), vitamins, herbal products and other supplements.

My Medication-Related Action Plan	
Patient Identifier:	Date of Birth:
Primary Physician:	Physician Phone:
Primary Pharmacy:	Pharmacy Phone:
Pharmacist/Student Intern:	Date prepared:
The list below has important Action Steps to help you get the most from your medications. Follow the checklist to help you work with your pharmacist and physician(s) to manage your medications AND make notes of your actions next to each item on your list.	
Action steps → What I need to do…..	Notes → What I did and when I did it…..

While intended to serve as a communication aid between patient (or other user) and health care provider, the MAP is not a substitute for obtaining health care advice or treatment. You should consult with a healthcare professional before starting any diet, exercise or supplementation program, before taking any medication, or if you have or suspect you might have a health problem.

Pharmacist Action Plan *List the medication-related problems identified and the proposed interventions to resolve these problems*		
Patient Identifier:		Date of Birth:
Pharmacist/Student Intern:		Date Prepared:
Medications or Conditions of Concern	Medication Related Problem	Intervention
High / Mid / Low Priority:		
High / Mid / Low Priority:		
High / Mid / Low Priority:		
High / Mid / Low Priority:		
High / Mid / Low Priority:		
High / Mid / Low Priority:		
Recommendations for Follow-up:		
Outcome of Review:		
Copy of PMR and MAP given to pt? Y / N	Referral made? Y / N	If Yes, to whom?

Pharmacist Action Plan Progress Notes		
Patient Identifier:	Date of Birth:	
Pharmacist/Student Intern:		
Date	Action	Follow-up Required?

Appendix A4

Classification of Medication and Health-Related Problems and Types of Pharmacist Recommendations

Classification of Medication and Health-Related Problems and Types of Pharmacist Recommendations			
Medication-Related Problems		**Recommendation Type**	
A prob	Drug Product Selection	A rec	Drug-related
1	Drug needed, but not prescribed	1	Add drug
2	Prescribed drug not needed	2	Discontinue drug
3	Therapeutic duplication*	3	Change drug
4	Drug Efficacy*	4	Change dose
5	Drug Safety*	5	Change drug to over-the-counter (OTC)
6	Cost/Formulary Interchange*	6	Change dosage form
B prob	Regimen	7	Change route
1	Dose	8	Change schedule/duration
2	Schedule/Duration	9	Drug efficacy/safety lab monitoring
3	Route	10	Patient drug assistance program
4	Dosage Form	11	Prilosec coupon
C prob	Precaution/Contraindication/ Interaction	B rec	Preventative Care
1	Age*	1	Thyroid-stimulating hormone
2	Diseases or condition*	2	DEXA Scan
3	Drug*	3	Cholesterol screening
4	Food	4	Mammography/breast exam
5	Laboratory*	5	Sigmoidoscopy/colonoscopy
D prob	Adverse effects	6	Stool occult blood
1	Side Effect	7	Depression screening
2	Additive effects	8	Comprehensive metabolic profile
3	Allergy	9	Liver function tests
4	Toxicity	10	Tetanus vaccination
E prob	Patient product misuse	11	Pneumococcal vaccination
1	Underuse	12	Influenza vaccination
2	Overuse	C rec	Diabetic Care
F prob	Preventative care needs	1	Eye exam
G prob	Education	2	Hemoglobin A1C
		3	Urine/creatinine ratio
		4	Foot exam
		D rec	Education
		1	Alcohol education
		2	Smoking cessation education
		3	Disease management education

Prob. = problem; Rec. = recommendations

Appendix A 5

Classification of students' MTM Interventions (Medication-Related Problems (MRPs) and Needs, Actions-Related to Other Health Care Providers, and Types of Recommendations)

Classification of students' MTM Interventions (Medication-Related Problems (MRPs) and Needs, Actions-Related to Other Health Care Providers, and Types of Recommendations)			
Medication and Health-Related Problems			
A prob.	Drug Product Selection	B prob.	Regimen
1	Over-the-counter (OTC) and herbal supplements	1	Dose
2	Drug needed, but not prescribed	2	Schedule/duration
		3	Route
		4	Dosage Form
3	Prescribed drug not needed	5	Medication administration technique
4	Therapeutic duplication	6	Route of administration
5	Drug Efficacy	7	Other
6	Drug Safety	D prob.	Adverse Effects and Use
7	Cost/formulary Interchange	1	Additive effects
C prob.	Precaution/Interaction/Contraindication	2	Allergy
1	Age	3	Toxicity
2	Diseases or condition	4	Underuse
3	Drug	5	Overuse
4	Food	F prob.	Social Histories and Lifestyle Issues
5	Alcohol	1	Smoking
6	Laboratory	2	Excessive Alcohol consumption
7	Pregnancy/Nursing	3	Lack of exercise
E prob.	Immunization	4	Obesity
G prob.	Lack of Understanding Drug Indication and Continuity of Care	5	Poor diet
1	Lack of understanding drug indication	6	Poor sleep
2	Continuity of care	H prob.	Disease Monitoring and Control
		A	Hypertension
		1	Poor self –monitoring of blood pressure
		2	Lack of blood pressure lab

		B	Diabetes
		1	Poor self-monitoring of blood glucose
		2	Lack A1C check
		3	Lack of eye exam
		4	Lack of foot inspection
		C	Dyslipidemia
		1	Poor self-monitoring of lipid
		2	Lack of foot inspection
Action Related to Other Health Care Providers			
1	Contact health care provider	2	Ask patients to contact health care provider
3	Counsel patients/caregiver	4	Education
5	Referral to specialist		
Type of Recommendations			
A rec.	Drug-Related	B rec.	Preventative Care
1	Over-the-counter medication recommendation	1	Health lab Monitoring
1	Add drug	2	Cholesterol screening
2	Discontinue drug	3	Depression screening
3	Change drug	4	Mammography/breast exam
4	Change dose	5	Pap smear
5	Change drug to over-the-counter (OTC)	6	Sigmoidoscopy/colonoscopy
6	Change dosage form	7	Stool occult blood
7	Change route	D rec.	Diabetic, Hypertensive and Dyslipidemic Monitoring and Control
8	Change schedule/duration	1	Blood pressure monitoring/request blood pressure lab
9	Drug efficacy/safety lab monitoring	2	Blood glucose monitoring/request A1c lab
10	Request refill	3	Foot exam
C rec.	Immunizations	4	Eye exam
1	Influenza vaccination	5	Lipids test
2	Pneumococcal vaccination		
3	Zostavax/shingles vaccination		
4	Tetanus vaccination		
5	Hepatitis A vaccination		

6	Hepatitis B vaccination		
7	Meningococcal vaccination		
E rec.	Smoking and Alcohol Education		
1	Smoking cessation education		
2	Alcohol education		

Prob. = problem; Rec. = recommendations

Appendix A6

Walgreens Preferred Medication List — Medication Category Guide

Walgreens Health Initiatives

PML—Medication Categories Guide

Effective October 1, 2010

You can make the most of your pharmacy benefit plan and control your prescription medication costs by using this Preferred Medication List. Be sure to share this list with your doctor to select cost-effective medications that are clinically appropriate to treat your condition or maintain your health.

This Preferred Medication List (PML) was developed by Walgreens Health Initiatives, your plan sponsor's pharmacy benefit manager, under the direction of a committee of doctors and pharmacists. All medications on this list are preferred by your plan.

Understanding Your Tiered Copays

Your pharmacy benefit plan offers three categories—or tiers—of medications that determine your costs (copays):

1st tier: Generics. Generics contain the same active ingredient as their brand-name equivalents and offer the same effectiveness and safety. Some generics use a brand name instead of a chemical name. Both have the lowest copay.

2nd tier: Preferred. Medications in this tier have been selected by your pharmacy benefit plan as preferred-brand medications. They have higher copays than generics but are less costly than nonpreferred medications on the third tier.

3rd tier: Nonpreferred. Because a generic version or a second-tier alternative is available, nonpreferred medications have higher copays and are not listed on the PML.

How to Use This Guide

Whenever possible, have your doctor consult this guide for the lowest-cost brand-name and generic medications available for your therapy. Some tips to keep in mind when using this guide:

- Therapeutic categories are listed alphabetically in all UPPERCASE letters in black boxes. Therapeutic classes in each category are printed in gray boxes.
- Types of medications in each class are printed in *italics*.
- Generic medications are listed in lowercase letters below the word generic. Brand-name generic medications have the first letter in Uppercase.
- Preferred-brand medications are listed in UPPERCASE letters below the word BRAND.
- Some medications treat more than one condition. Check different categories for your medication.

All medications on the PML have been approved by the FDA.

Additional Information

Not all medications are listed in this PML. Medication coverage and copays may vary from plan to plan. For more information specific to your plan, log on and register online at WalgreensHealth.com.You can also access the alphabetical version at the above website.

Please note: The PML is subject to change without notice.

Call Us With Questions

For assistance, please call the Walgreens Customer Care Center toll free at 800-207-2568.

Continued

ANTIASTHMATICS AND COPD

Bronchial Dilators

generic
albuterol
ipratropium/albuterol solution
ipratropium bromide
theophylline anhydrous

BRAND
ATROVENT HFA
COMBIVENT
FORADIL
PERFOROMIST
PROAIR HFA
PROVENTIL HFA
SEREVENT DISKUS
SPIRIVA
UNIPHYL
VENTOLIN HFA
XOPENEX SOLUTION

Bronchial Dilator and Glucocorticoid Combinations

BRAND
ADVAIR
SYMBICORT

Corticosteroid Inhaled Medications

generic
budesonide suspension

BRAND
ASMANEX
AZMACORT
FLOVENT
PULMICORT FLEXHALER
QVAR

Leukotriene Receptor Antagonists

BRAND
SINGULAIR

Mast Cell Stabilizers

generic
cromolyn nebulized solution

BRAND
INTAL INHALER

ANTI-INFECTIVES

Antifungal Agents

generic
fluconazole
itraconazole
ketoconazole oral
nystatin
terbinafine tablet
terconazole

BRAND
GRIS-PEG
VFEND

Antimalarial Agents

generic
hydroxychloroquine
mefloquine

BRAND
MALARONE

Antiparasitic and Antiprotozoal Agents

generic
malathion
mebendazole
metronidazole
permethrin

Antivirals

generic
acyclovir

BRAND
TAMIFLU

Cytomegalovirus

BRAND
VALCYTE

Herpes

generic
famciclovir
valacyclovir

Cephalosporins

1st Generation

generic
cefadroxil
cephalexin

2nd Generation

generic
cefaclor
cefprozil
cefuroxime

3rd Generation

generic
cefdinir
cefpodoxime

Intravaginal Antibiotics

generic
metronidazole vaginal 0.75% gel

BRAND
GYNAZOLE 1

Macrolides

generic
azithromycin
clarithromycin
clarithromycin ER
erythromycin oral

Nitrofuran Derivatives

generic
nitrofurantoin macrocrystals

Penicillins

generic
amoxicillin
amoxicillin trihydrate/ potassium clavulanate
ampicillin
dicloxacillin
penicillin V potassium

Quinolones

generic
ciprofloxacin
ciprofloxacin ER
ofloxacin

BRAND
LEVAQUIN

Sulfonamides

generic
sulfamethoxazole/ trimethoprim
Sulfatrim

Tetracyclines

generic
doxycycline
minocycline
tetracycline

Tuberculosis Agents

generic
isoniazid
rifampin

Miscellaneous

generic
chlorhexidine
clindamycin oral
trimethoprim

BLOOD FORMATION AND COAGULATION

Anticoagulants (Blood Thinners)

generic
Jantoven
warfarin

BRAND
COUMADIN

Platelet Inhibitors

generic
cilostazol
dipyridamole
pentoxifylline ER
ticlopidine

BRAND
PLAVIX

Miscellaneous

generic
anagrelide

BRAND
MEPHYTON

CANCER THERAPY

All oral agents under this class are on the PML, if FDA approved.

CARDIOVASCULAR

Blood Pressure Agents

ACE Inhibitors

generic
benazepril
captopril
enalapril
fosinopril
lisinopril
moexipril
quinapril
ramipril
trandolapril

ACE Inhibitor Combinations

generic
amlodipine/benazepril
benazepril/hctz
captopril/hctz
enalapril/hctz
fosinopril/hctz
lisinopril/hctz
moexipril/hctz
quinapril/hctz

BRAND
LOTREL 5/40
LOTREL 10/40

Angiotensin Receptor Blockers (ARBs)

generic
losartan

BRAND
BENICAR
DIOVAN

Angiotensin Receptor Blocker (ARBs) Combinations

generic
losartan/hctz

BRAND
AZOR
BENICAR HCT
DIOVAN HCT
EXFORGE
EXFORGE HCT

Beta-Blockers

generic
acebutolol
atenolol
bisoprolol
carvedilol
labetalol
metoprolol
metoprolol ER
nadolol
pindolol
propranolol
propranolol LA
sotalol

BRAND
BYSTOLIC
COREG CR

Blood Pressure Agents—Combinations

generic
atenolol/chlorthalidone
bisoprolol/hctz
metoprolol/hctz

Calcium Channel Blockers

generic
Afeditab CR
amlodipine
Cartia XT
Dilt XR
diltiazem
diltiazem ER
felodipine ER
Nifediac CC
Nifedical XL
nifedipine ER
nisoldipine ER
Taztia XT
verapamil
verapamil ER

Central Nervous System Agents

generic
clonidine
guanfacine
methyldopa

Renin Inhibitors

BRAND
TEKAMLO

Generic medications—listed in all lowercase letters or beginning with an Uppercase letter—are on tier 1.

TEKTURNA
TEKTURNA-HCT
VALTURNA

Vasodilators

generic
hydralazine
isosorbide dinitrate
isosorbide mononitrate
isosorbide mononitrate ER
nitroglycerin
Nitroquick

BRAND
NITROLINGUAL SPRAY

Cholesterol Agents

Cholesterol Binding Agents

generic
cholestyramine

BRAND
WELCHOL

Cholesterol Reducing Agents—Statins

generic
lovastatin
pravastatin
simvastatin

BRAND
CRESTOR
LIPITOR

Cholesterol Reducing Agents—Miscellaneous

generic
fenofibrate
gemfibrozil

BRAND
LOVAZA
NIASPAN
TRICOR
TRILIPIX
ZETIA

Diuretics

Loop

generic
bumetanide
furosemide
torsemide

Potassium Sparing

generic
amiloride
eplerenone
spironolactone

Potassium Sparing Combinations

generic
amiloride/hctz
spironolactone/hctz
triamterene/hctz

Thiazides

generic
chlorthalidone
hydrochlorothiazide
indapamide
metolazone

Miscellaneous

generic
acetazolamide

Heart Rhythm Stabilizers

generic
amiodarone
Pacerone

BRAND
MULTAQ

Digitalis Glycosides

generic
digoxin

BRAND
LANOXIN

Miscellaneous

BRAND
CADUET
RANEXA

CENTRAL NERVOUS SYSTEM AGENTS

Alzheimer Agents

generic
galantamine
galantamine ER
rivastigmine

BRAND
ARICEPT
EXELON PATCHES
NAMENDA

Analgesics (Pain Management)

Narcotics

generic
acetaminophen/codeine
butalbital/caffeine/ acetaminophen/codeine
Endocet
fentanyl transdermal
hydrocodone/ acetaminophen
hydrocodone/ibuprofen
hydromorphone
meperidine
morphine sulfate ER
oxycodone
oxycodone/acetaminophen
propoxyphene/ acetaminophen
Roxicet Tablet

BRAND
OPANA ER
OXYCONTIN

Non-Narcotics (NSAIDs)

generic
diclofenac
diflunisal
etodolac
flurbiprofen
ibuprofen
indomethacin
ketorolac
meloxicam
nabumetone
naproxen
naproxen sodium
oxaprozin
piroxicam
salsalate
sulindac

Non-Narcotic Agents—Other

generic
butalbital/acetaminophen/ caffeine

Miscellaneous

generic
tramadol
tramadol ER
tramadol/acetaminophen

BRAND
SUBOXONE

Antianxiety Agents

generic
alprazolam
alprazolam XR
buspirone
clorazepate
diazepam
lorazepam
oxazepam

Anticonvulsants (Seizures)

generic
carbamazepine
carbamazepine ER
clonazepam
divalproex
divalproex ER
gabapentin
lamotrigine
levetiracetam
oxcarbazepine
phenobarbital
phenytoin ER
primidone
topiramate
valproic acid
zonisamide

BRAND
CARBATROL
DEPAKOTE
DEPAKOTE ER
DIASTAT
DILANTIN
GABITRIL
KEPPRA
LYRICA
PHENYTEK
TEGRETOL
TEGRETOL XR
TRILEPTAL

Antidepressants

Alpha-2 Receptor Antagonist

generic
mirtazapine
mirtazapine soltab

NDRI

generic
bupropion
bupropion ER

SARI

generic
nefazodone
trazodone

SNRI

generic
venlafaxine
venlafaxine ER capsules

BRAND
CYMBALTA
PRISTIQ

SSRI

generic
citalopram
fluoxetine
fluvoxamine
paroxetine
paroxetine CR
sertraline

BRAND
LEXAPRO

TCA

generic
amitriptyline
desipramine
doxepin
imipramine
nortriptyline

Miscellaneous

BRAND
SYMBYAX

Antiparkinsonism Agents

Anticholinergic

generic
amantadine
benztropine
trihexyphenidyl

Miscellaneous

generic
carbidopa/levodopa
pramipexole
ropinirole
selegiline

BRAND
AZILECT
COMTAN
STALEVO

Antipsychotics

generic
clozapine
haloperidol
risperidone

BRAND
ABILIFY
GEODON
SEROQUEL
SEROQUEL XR
ZYPREXA
ZYPREXA ZYDIS

Attention Deficit Hyperactivity Disorder (ADHD) Agents

generic
amphetamine mixed salts
dextroamphetamine/ amphetamine
Methylin ER
Methylin Tablet
methylphenidate
methylphenidate ER

BRAND
CONCERTA
STRATTERA
VYVANSE

Bipolar Agents

generic
lithium carbonate
lithium carbonate ER

BRAND
LITHOBID

Generic medications—listed in all lowercase letters or beginning with an Uppercase letter—are on tier 1.

Migraine Agents

generic
sumatriptan
BRAND
MAXALT
MAXALT MLT
TREXIMET
ZOMIG
ZOMIG ZMT

Insomnia (Sleep Aids)

generic
estazolam
flurazepam
hydroxyzine
temazepam
triazolam
zaleplon
zolpidem
BRAND
AMBIEN CR

COUGH, COLD AND ALLERGY AGENTS

Antiallergy—Antihistamine Agents

generic
fexofenadine

Cough and Cold Agents

generic
benzonatate
Cheratussin AC
C-Phen DM
guaifenesin/codeine
promethazine/codeine
Promethazine VC with codeine
Promethazine with DM
pseudoephedrine/chlorpheniramine

DIABETIC AGENTS AND MONITORING

Antidiabetic Agents—Oral

generic
acarbose
glimepiride
glipizide
glipizide ER
glipizide/metformin
glyburide
glyburide/metformin
glyburide micronized
metformin
metformin ER
nateglinide
BRAND
ACTOPLUS MET
ACTOPLUS MET XR
ACTOS
AVANDAMET
AVANDARYL
AVANDIA
DUETACT
JANUMET
JANUVIA
ONGLYZA
PRANDIN

Blood Sugar Diagnostics

BRAND
ACCU-CHEK [Active, Advantage, Aviva, Comfort Curve, Compact, Test Strips]
NOVOFINE
ONE TOUCH [Basic, FastTake, Suresoft, SureStep, Test Strips, Ultra, Ultra 2, Ultramini, Ultra Smart]
SOFTCLIX LANCETS
SOFT TOUCH LANCETS

Blood Sugar Increasing Agents

BRAND
GLUCAGEN HYPOKIT
GLUCAGON EMERGENCY KIT

Insulins

BRAND
HUMALOG
HUMALOG MIX 50/50
HUMALOG MIX 75/25
HUMULIN 50/50
HUMULIN 70/30
HUMULIN N
HUMULIN R
LANTUS
LEVEMIR
NOVOLIN 70/30
NOVOLIN INNOLET 70/30
NOVOLIN N
NOVOLIN R
NOVOLOG
NOVOLOG MIX 70/30

Miscellaneous

BRAND
BYETTA
SYMLIN

EYE, EAR, NOSE AND THROAT AGENTS

Allergy and Antihistamine Agents—Eye

generic
azelastine
cromolyn
BRAND
ALAMAST
PATADAY
PATANOL

Allergy Agents—Nose

generic
flunisolide
fluticasone
BRAND
NASONEX

Antibiotics—Ear

generic
neomycin/polymyxin/hydrocortisone
ofloxacin otic
BRAND
CIPRODEX

Antibiotics—Eye

generic
erythromycin
Gentak
gentamicin
neomycin/polymyxin B/gramicidin solution
ofloxacin 0.3% solution
polymyxin B/trimethoprim
sulfacetamide
tobramycin
tobramycin/dexamethasone
BRAND
TOBRADEX EYE OINTMENT
VIGAMOX

Antihistamines—Nose

generic
azelastine
BRAND
ASTEPRO

Anti-Inflammatory Agents—Eye

generic
diclofenac ophthalmic
neomycin/polymyxin B/dexamethasone
prednisolone 1% drops
BRAND
LOTEMAX

Glaucoma Agents

generic
brimonidine tartrate
dorzolamide
dorzolamide/timolol
levobunolol
pilocarpine
timolol maleate
BRAND
ALPHAGAN P 0.1%
AZOPT
BETIMOL
LUMIGAN
XALATAN

Nose and Ear Topical Agents

generic
A/B Otic
Acetasol HC
antipyrine/benzocaine

Miscellaneous

generic
atropine 1% ophthalmic drops
BRAND
RESTASIS

GASTROINTESTINAL AGENTS

Antispasmodics

generic
dicyclomine
hyoscyamine sulfate

Chronic Inflammatory Bowel Disorder Agents

generic
balsalazide
mesalamine
BRAND
ASACOL
CANASA
ENTOCORT EC
LIALDA
PENTASA

Diarrhea Agents

generic
diphenoxylate/atropine
Lonox

Gastric Acid Secretion Reducers and Ulcer Therapy Agents

generic
cimetidine
famotidine
lansoprazole
misoprostol
nizatidine
omeprazole
pantoprazole
ranitidine tablet
sucralfate
BRAND
DEXILANT
KAPIDEX
NEXIUM
PYLERA

Intestinal Motility Stimulants

generic
metoclopramide

Laxatives

generic
Enulose
lactulose
polyethylene glycol 3350
polyethylene glycol 3350/electrolyte solution
BRAND
HALFLYTELY
HALFLYTELY WITH FLAVOR PACKS
HALFLYTELY-BISACODYL
MOVIPREP
VISICOL

Nausea Agents

generic
meclizine
ondansetron
ondansetron ODT
prochlorperazine
promethazine
trimethobenzamide
BRAND
EMEND

Pancreatic Enzymes

BRAND
CREON
PANCREASE MT
PANCRECARB
ULTRASE
ULTRASE MT
VIOKASE

Generic medications—listed in all lowercase letters or beginning with an Uppercase letter—are on tier 1.

Miscellaneous

generic
sulfasalazine
ursodiol

HIV AGENTS

All medications used for the treatment of HIV are on the PML, if FDA approved.

HORMONES

Antidiuretic and Vasopressor Hormones

generic
desmopressin

Contraceptives (Birth Control)

Intravaginal

BRAND
NUVARING

Oral—Monophasic

generic
Apri
Aviane
Cryselle
Gianvi
Junel FE
Lessina
Levora
Low-Ogestrel
Lutera
Microgestin
Microgestin FE
Necon
Nortrel
Ocella
Ogestrel
Portia
Sprintec 28
Zovia

Oral—Biphasic

generic
Kariva
Necon

Oral—Triphasic

generic
Enpresse
Nortrel 7/7/7
Tilia FE
Tri-Legest FE
Tri-Lo-Sprintec
TriNessa
Tri-Sprintec
Trivora-28
Velivet 28

Oral—Progestin

generic
Camila
Errin
Nora-BE
norethindrone

Hormone Replacement Therapy (Menopause)

generic
estradiol patch
estradiol tablet
estropipate

BRAND
CENESTIN
CLIMARA PRO
ESTRACE CREAM
ESTRADERM
ESTRING
FEMHRT
FEMRING
MENEST
PREFEST
PREMARIN
PREMARIN VAGINAL
PREMPHASE
PREMPRO
VAGIFEM
VIVELLE-DOT

Glucocorticoids

generic
dexamethasone
fludrocortisone
hydrocortisone
methylprednisolone
prednisolone
15mg/5ml syrup
prednisone

Osteoporosis Agents

generic
alendronate
calcitonin/salmon

BRAND
ACTONEL
ACTONEL WITH CALCIUM
BONIVA TABLET
EVISTA

Progestins

generic
medroxyprogesterone

BRAND
PROMETRIUM

Testosterone

BRAND
ANDRODERM
ANDROGEL

Thyroid Hormones

generic
levothyroxine sodium
liothyronine
methimazole
propylthiouracil

BRAND
ARMOUR THYROID
CYTOMEL
LEVOTHROID
LEVOXYL
SYNTHROID
THYROLAR

Miscellaneous

generic
bromocriptine
cabergoline

IMMUNE SYSTEM AGENTS

generic
azathioprine

BRAND
CELLCEPT

MUSCULOSKELETAL AGENTS

Arthritis Agents

generic
leflunomide

Gout Agents

generic
allopurinol
colchicine
probenecid

Muscle Relaxants

generic
baclofen
carisoprodol
chlorzoxazone
cyclobenzaprine
metaxalone
methocarbamol
orphenadrine
tizanidine

Miscellaneous

generic
methotrexate

SKIN AND MUCOUS MEMBRANE AGENTS

Acne Agents—Oral

generic
Amnesteem
Claravis

Acne and Vitamin A Agents—Topical

generic
adapalene
clindamycin/benzoyl peroxide gel
tretinoin

BRAND
AZELEX
BENZACLIN PUMP
DIFFERIN 0.1% LOTION
DIFFERIN 0.3% GEL
DUAC CS

Rosacea Agents

generic
metronidazole topical cream, lotion

BRAND
FINACEA
METROGEL 1% KIT
METROGEL TOPICAL 1% GEL
NORITATE

Antibiotics

generic
clindamycin topical
erythromycin/benzoyl peroxide gel
erythromycin topical
mupirocin
silver sulfadiazine
SSD

Antifungals

generic
ciclopirox
clotrimazole/betamethasone
econazole nitrate
ketoconazole topical
nystatin/triamcinolone

Antineoplastics and Immunosuppressants

generic
imiquimod

BRAND
CARAC
EFUDEX CREAM
ELIDEL
PROTOPIC
SOLARAZE

Antipsoriatic Agents

generic
calcipotriene solution

BRAND
TACLONEX

Antivirals

BRAND
ZOVIRAX 5% OINTMENT

Corticosteroids

Listed by potency: Group I is most potent; Group IV is least potent.

Group I

generic
betamethasone dipropionate augmented 0.05% cream, ointment
clobetasol 0.05% cream, gel, ointment, solution
halobetasol

Group II

generic
betamethasone dipropionate 0.05% cream, lotion, ointment
desoximetasone 0.25% cream, ointment
fluocinonide 0.05% cream, gel, ointment, solution
triamcinolone 0.5% cream, ointment

Group III

generic
betamethasone valerate 0.1% cream, lotion, ointment
hydrocortisone valerate 0.2% ointment
mometasone furoate 0.1% cream, ointment, solution
triamcinolone 0.025% cream, lotion, ointment
triamcinolone 0.1% cream, lotion, ointment

Group IV

generic
desonide 0.05% cream, lotion, ointment
fluocinolone 0.01% solution
hydrocortisone 2.5% cream, lotion, ointment

Miscellaneous

generic
lidocaine/prilocaine cream
BRAND
LIDODERM

UROLOGIC AGENTS

Benign Prostatic Hypertrophy Agents

5-Alpha Reductase Inhibitors

generic
finasteride
BRAND
AVODART

Alpha Blockers

generic
doxazosin
tamsulosin
terazosin

Antispasmodic/Anti-cholinergic Agents (Bladder Control)

generic
bethanechol
oxybutynin
oxybutynin ER
BRAND
DETROL
DETROL LA
TOVIAZ
VESICARE

Urinary pH Modifiers

generic
potassium citrate ER

Urinary Tract Anesthetics and Analgesics

generic
phenazopyridine

VITAMINS, MINERALS AND ELECTROLYTES

All generic prenatal vitamins are on the PML.

Electrolyte Replacements

generic
Klor-Con
potassium chloride ER

Electrolyte Stabilizers

generic
calcium acetate capsule
BRAND
FOSRENOL
RENAGEL
RENVELA

MISCELLANEOUS AGENTS

Antiallergic and Anaphylaxis Agents

generic
epinephrine
BRAND
EPIPEN JR
TWINJECT

Dry Mouth—Sjogren's Syndrome Agents

generic
pilocarpine tablet
BRAND
EVOXAC

Myasthenia Gravis Agents

generic
pyridostigmine

Pulmonary Arterial Hypertension Agents

BRAND
LETAIRIS
REVATIO
TRACLEER

SPECIALTY PHARMACY CATEGORIES

Coverage may vary by plans/pharmacies. Register on MyWHI.com and click on Drug costs & coverage.

Antibiotics

BRAND
TOBI

Antihemophilic Factors

BRAND
HUMATE-P
RECOMBINATE

Anti-Inflammatory Agents and DMARDs

BRAND
ENBREL
HUMIRA
KINERET

Antiparkinsonism Agents

BRAND
APOKYN

Antivirals

BRAND
SYNAGIS

Blood Cell Stimulators

Red Blood Cells

BRAND
ARANESP
EPOGEN
PROCRIT

White Blood Cells

BRAND
NEUPOGEN

Enzymes

BRAND
ALDURAZYME
CEREZYME
FABRAZYME
PULMOZYME

Fertility Agents

generic
Novarel
BRAND
FOLLISTIM AQ
GONAL-F

Growth Hormones

BRAND
HUMATROPE
NUTROPIN
NUTROPIN AQ

Heparin and Related Agents (LMWH)

generic
enoxaparin
BRAND
ARIXTRA
FRAGMIN

Hepatitis Agents

Hepatitis B

BRAND
BARACLUDE
EPIVIR-HBV
HEPSERA
VIREAD

Hepatitis C

generic
ribavirin
BRAND
INFERGEN
PEGASYS
PEG-INTRON
PEG-INTRON REDIPEN

Immunomodulators

BRAND
INTRON A

Multiple Sclerosis Agents

BRAND
AVONEX
BETASERON
COPAXONE
REBIF

Osteoporosis Agents

BRAND
FORTEO

Proteinase Inhibitors

BRAND
PROLASTIN

Psoriasis Agents

BRAND
AMEVIVE

Miscellaneous

generic
octreotide
BRAND
ACTIMMUNE
ELIGARD
LUPRON DEPOT
SANDOSTATIN LAR
SUPARTZ

Generic medications—listed in all lowercase letters or beginning with an Uppercase letter—are on tier 1.

References

1. Medicare Prescription Drug, Improvement, and Modernization Act of 2003. Washington, DC: US Department of Health and Human Services 2003: http://www.gpo.gov/fdsys/pkg/PLAW-108publ173/pdf/PLAW-108publ173.pdf. Accessed December 8, 2003.
2. Bluml BM. Definition of medication therapy management: development of professionwide consensus. *Journal of the American Pharmacists Association.* Sep-Oct 2005;45(5):566-572.
3. Pellegrino AN, Martin MT, Tilton JJ, Touchette DR. Medication therapy management services: definitions and outcomes. *Drugs.* 2009;69(4):393-406.
4. Center of Medicare & Medicaid Services. 2011 Medicare Part D Medication Therapy Management (MTM) Programs. 2011; https://http://www.cms.gov/prescriptiondrugcovcontra/downloads/MTMFactSheet2011063011Final.pdf. Accessed November 12, 2012.
5. Pindolia VK, Stebelsky L, Romain TM, Luoma L, Nowak SN, Gillanders F. Mitigation of medication mishaps via medication therapy management. *The Annals of Pharmacotherapy.* Apr 2009;43(4):611-620.
6. McDonough RP, Doucette WR. Drug therapy management: an empirical report of drug therapy problems, pharmacists' interventions, and results of pharmacists' actions. *Journal of the American Pharmacists Association.* Jul-Aug 2003;43(4):511-518.
7. Christensen DB, Roth M, Trygstad T, Byrd J. Evaluation of a pilot medication therapy management project within the North Carolina State Health Plan. *Journal of the American Pharmacists Association.* Jul-Aug 2007;47(4):471-483.
8. Doucette WR, McDonough RP, Klepser D, McCarthy R. Comprehensive medication therapy management: identifying and resolving drug-related issues in a community pharmacy. *Clinical Therapeutics.* Jul 2005;27(7):1104-1111.
9. Hanlon JT, Weinberger M, Samsa GP, et al. A randomized, controlled trial of a clinical pharmacist intervention to improve inappropriate prescribing in elderly outpatients with polypharmacy. *The American Journal of Medicine.* Apr 1996;100(4):428-437.
10. Moczygemba LR, Barner JC, Lawson KA, et al. Impact of telephone medication therapy management on medication and health-related problems, medication adherence, and medicare part d drug costs: a 6-month follow up. *American Journal of Geriatric Pharmacotherapy.* Oct 2011;9(5):328-338.

11. Zillich AJ, Jaynes HA, Snyder ME, et al. Evaluation of Specialized Medication Packaging Combined With Medication Therapy Management: Adherence, Outcomes, and Costs Among Medicaid Patients. *Medical Care.* Apr 11 2012.
12. Perera PN, Guy MC, Sweaney AM, Boesen KP. Evaluation of prescriber responses to pharmacist recommendations communicated by fax in a medication therapy management program (MTMP). *Journal of Managed Care Pharmacy.* Jun 2011;17(5):345-354.
13. Lam A. Practice Innovations: Delivering Medication Therapy Management Services via Videoconference Interviews. *Consultant Pharmacist.* Oct 2011;26(10):764-774.
14. Isetts BJ, Schondelmeyer SW, Artz MB, et al. Clinical and economic outcomes of medication therapy management services: the Minnesota experience. *Journal of the American Pharmacists Association.* Mar-Apr 2008;48(2):203-211; 203 p following 211.
15. Ramalho de Oliveira D, Brummel AR, Miller DB. Medication therapy management: 10 years of experience in a large integrated health care system. *Journal of Managed Care Pharmacy.* Apr 2010;16(3):185-195.
16. Barnett MJ, Frank J, Wehring H, et al. Analysis of pharmacist-provided medication therapy management (MTM) services in community pharmacies over 7 years. *Journal of Managed Care Pharmacy.* Jan-Feb 2009;15(1):18-31.
17. Bunting BA, Cranor CW. The Asheville Project: long-term clinical, humanistic, and economic outcomes of a community-based medication therapy management program for asthma. *Journal of the American Pharmacists Association.* Mar-Apr 2006;46(2):133-147.
18. Bunting BA, Smith BH, Sutherland SE. The Asheville Project: clinical and economic outcomes of a community-based long-term medication therapy management program for hypertension and dyslipidemia. *Journal of the American Pharmacists Association.* Jan-Feb 2008;48(1):23-31.
19. Cook DM, Mburia-Mwalili A. Medication therapy management favors large pharmacy chains and creates potential conflicts of interest. *Journal of Managed Care Pharmacy.* Jul-Aug 2009;15(6):495-500.
20. Alkhateeb FM, Clauson KA, McCafferty R, Latif DA. Physician attitudes toward pharmacist provision of medication therapy management services. *Pharmacy World and Science.* Aug 2009;31(4):487-493.
21. Blake KB, Madhavan SS. Perceived barriers to provision of medication therapy management services (MTMS) and the likelihood of a pharmacist to work in a pharmacy that provides MTMS. *The Annals of Pharmacotherapy.* Mar 2010;44(3):424-431.
22. McGrath SH, Snyder ME, Duenas GG, Pringle JL, Smith RB, McGivney MS. Physician perceptions of pharmacist-provided medication therapy management: qualitative analysis. *Journal of the American Pharmacists Association.* Jan-Feb 2010;50(1):67-71.

23. MacIntosh C, Weiser C, Wassimi A, et al. Attitudes toward and factors affecting implementation of medication therapy management services by community pharmacists. *Journal of the American Pharmacists Association.* Jan-Feb 2009;49(1):26-30.
24. Lounsbery JL, Green CG, Bennett MS, Pedersen CA. Evaluation of pharmacists' barriers to the implementation of medication therapy management services. *Journal of the American Pharmacists Association.* Jan-Feb 2009;49(1):51-58.
25. Hirsch JD, Gagnon JP, Camp R. Value of pharmacy services: perceptions of consumers, physicians, and third party prescription plan administrators. *American Pharmacy.* Mar 1990;NS30(3):20-25.
26. Thompson CA. Minnesota pharmacists use CPT codes. *The American Journal of Health-System Pharmacy (AJHP).* Jul 1 2006;63(13):1208, 1210.
27. Delivering Medication Therapy Management Services in the Community. 2009; http://www.pharmacist.com/Content/NavigationMenu3/ContinuingEducation/CertificateTrainingProgram/DeliveringMedicationTherapyManagementintheCommunity/Delivering_Medicatio.htm. Accessed March 22, 2012.
28. Siracuse MV, Schondelmeyer SW, Hadsall RS, Schommer JC. Assessing career aspirations of pharmacy students. *American Journal of Pharmaceutical Education.* 2004;68(3):75.
29. Chase P. Rethinking experiential education (or does anyone want a pharmacy student?). *American Journal of Pharmaceutical Education.* 2007;71(2).
30. Tomko JR, Runyon AL, Lassila H. Student self-assessed medication therapy management skills resulting from caring for uninsured patients using team-based care. *Currents in Pharmacy Teaching and Learning.* 2011;3(1):63-70.
31. Kuhn C, Powell PH, Sterrett JJ. Elective course on medication therapy management services. *American Journal of Pharmaceutical Education.* Apr 12 2010;74(3):40.
32. Agness CF, Huynh D, Brandt N. An introductory pharmacy practice experience based on a medication therapy management service model. *American Journal of Pharmaceutical Education.* Jun 10 2011;75(5):82.
33. Rovers J, Miller MJ, Koenigsfeld C, Haack S, Hegge K, McCleeary E. A guided interview process to improve student pharmacists' identification of drug therapy problems. *American Journal of Pharmaceutical Education.* Feb 10 2011;75(1):16.
34. Cerulli J, Malone M. Women's health promotion within a community advanced pharmacy practice experience. *American Journal of Pharmaceutical Education.* Apr 15 2008;72(2):25.
35. Lee SS, Schwemm AK, Reist J, et al. Pharmacists' and pharmacy students' ability to identify drug-related problems using TIMER (Tool to Improve Medications in the Elderly via Review). *American Journal of Pharmaceutical Education.* May 27 2009;73(3):52.

36. Eukel HN, Skoy ET, Frenzel JE. Provision of medication therapy management to university faculty and staff members by third-year pharmacy students. *American Journal of Pharmaceutical Education.* Dec 15 2010;74(10):182.
37. Hata M, Klotz R, Sylvies R, et al. Medication Therapy Management Services Provided by Student Pharmacists. *American Journal of Pharmaceutical Education.* 2012;76(3):51.
38. Begley KJ, Coover KL, Tilleman JA, Haddad AM, Augustine SC. Medication therapy management training using case studies and the MirixaPro platform. *American Journal of Pharmaceutical Education.* Apr 11 2011;75(3):49.
39. Gallimore CE, Thorpe JM, Trapskin K. Simulated medication therapy management activities in a pharmacotherapy laboratory course. *American Journal of Pharmaceutical Education.* Jun 10 2011;75(5):95.
40. Patterson BY. An advanced pharmacy practice experience in public health. *American Journal of Pharmaceutical Education.* Oct 15 2008;72(5):125.
41. Donihi AC, Weber RJ, Sirio CA, Mark SM, Meyer SM. An advanced pharmacy practice experience in inpatient medication education. *American Journal of Pharmaceutical Education.* Feb 19 2009;73(1):11.
42. Abdelhalim D, Mohundro BL, Evans JD. Role of student pharmacists in the identification and prevention of medication-related problems. *Journal of the American Pharmacists Association.* Sep-Oct 2011;51(5):627-630.
43. Kogan MD, Newacheck PW, Blumberg SJ, et al. State variation in underinsurance among children with special health care needs in the United States. *Pediatrics.* Apr 2010;125(4):673-680.
44. van Mil JWF, Westerlund LOT, Hersberger KE, Schaefer MA. Drug-related problem classification systems. *The Annals of Pharmacotherapy* 2004;38(5):859-867.
45. Van den Bemt PM, ACG Egberts. Drug-related problems: definitions and classification. *European Association of Hospital Pharmacists.* 2007;13(1):62-64.
46. International drug monitoring: the role of national centres. Report of a WHO meeting. *World Health Organization Technical Report Series* 1972; 1972/01/01:1-25. Available at: http://www.who-umc.org/graphics/24756.pdf. Accessed December 5, 2011.
47. Cousins DD, Heath WM. The National Coordinating Council for Medication Error Reporting and Prevention: promoting patient safety and quality through innovation and leadership. *Joint Commission Journal on Quality and Patient Safety.* Dec 2008;34(12):700-702.
48. van den Bemt PM, Egberts TC, de Jong-van den Berg LT, Brouwers JR. Drug-related problems in hospitalised patients. *Drug Safety : an International Journal of Medical Toxicology and Drug Experience.* Apr 2000;22(4):321-333.

49. Fijn R, Van den Bemt PM, Chow M, De Blaey CJ, De Jong-Van den Berg LT, Brouwers JR. Hospital prescribing errors: epidemiological assessment of predictors. *British Journal of Clinical Pharmacology.* Mar 2002;53(3):326-331.
50. Beso A, Franklin BD, Barber N. The frequency and potential causes of dispensing errors in a hospital pharmacy. *Pharmacy World and Science.* Jun 2005;27(3):182-190.
51. Teagarden JR, Nagle B, Aubert RE, Wasdyke C, Courtney P, Epstein RS. Dispensing error rate in a highly automated mail-service pharmacy practice. *Pharmacotherapy.* Nov 2005;25(11):1629-1635.
52. Ashcroft DM, Quinlan P, Blenkinsopp A. Prospective study of the incidence, nature and causes of dispensing errors in community pharmacies. *Pharmacoepidemiology and Drug Safety.* May 2005;14(5):327-332.
53. Bates DW, Cullen DJ, Laird N, et al. Incidence of adverse drug events and potential adverse drug events. Implications for prevention. ADE Prevention Study Group. *JAMA.* Jul 5 1995;274(1):29-34.
54. Osterberg L, Blaschke T. Adherence to medication. *The New England Journal of Medicine.* Aug 4 2005;353(5):487-497.
55. Hohl CM, Zed PJ, Brubacher JR, Abu-Laban RB, Loewen PS, Purssell RA. Do emergency physicians attribute drug-related emergency department visits to medication-related problems? *Annals of Emergency Medicine.* Jun 2010;55(6):493-502 e494.
56. Johnson JA, Bootman JL. Drug-related morbidity and mortality. A cost-of-illness model. *Archives of Internal Medicine.* Oct 9 1995;155(18):1949-1956.
57. Ernst FR, Grizzle AJ. Drug-related morbidity and mortality: updating the cost-of-illness model. *Journal of the American Pharmaceutical Association.* Mar-Apr 2001;41(2):192-199.
58. Aspden P, Institute of Medicine (U.S.). Committee on Identifying and Preventing Medication Errors. *Preventing medication errors.* Washington, DC: National Academies Press; 2007.
59. Centers for Disease Control and Prevention (U.S). National Diabetes Fact Sheet: General Information and National Estimates on Diabetes in the United States, 2007. Atlanta, GA: Centers for Disease Control and Prevention; 2008: http://www.cdc.gov/diabetes/pubs/pdf/ndfs_2007.pdf. Accessed April 8, 2012.
60. United States. Bureau of the Census. Statistical Abstract of the United States. Washington, DC: U.S. Dept. of Commerce, Economics and Statistics Administration, Bureau of the Census, Data User Services Division,; 2011: http://0-www.census.gov.iii-server.ualr.edu/prod/2011pubs/11statab/health.pdf. Accessed Nov 1, 2011.
61. Ranji UR, Wyn R, Salganicoff A, Yu H. Role of health insurance coverage in women's access to prescription medicines. *Women's Health Issues.* Nov-Dec 2007;17(6):360-366.

62. Medicare Program - General Information http://www.cms.gov/Medicare/Medicare-General-Information/MedicareGenInfo/index.html. Accessed November 29, 2012.
63. Medication therapy management in pharmacy practice: core elements of an MTM service model (version 2.0). *Journal of the American Pharmacists Association.* May-Jun 2008;48(3):341-353.
64. Moczygemba LR, Barner JC, Brown CM, et al. Patient satisfaction with a pharmacist-provided telephone medication therapy management program. *Research in Social & Administrative Pharmacy.* Jun 2010;6(2):143-154.
65. Welch EK, Delate T, Chester EA, Stubbings T. Assessment of the impact of medication therapy management delivered to home-based Medicare beneficiaries. *The Annals of Pharmacotherapy.* Apr 2009;43(4):603-610.
66. Hansen RA, Roth MT, Brouwer ES, Herndon S, Christensen DB. Medication therapy management services in North Carolina community pharmacies: current practice patterns and projected demand. *Journal of the American Pharmacists Association.* Nov-Dec 2006;46(6):700-706.
67. Hughes CM, McCann S. Perceived interprofessional barriers between community pharmacists and general practitioners: a qualitative assessment. *The British Journal of General Practice.* Aug 2003;53(493):600-606.
68. Burns A. Medication therapy management services: a critical review. *Journal of the American Pharmacists Association.* Sep-Oct 2005;45(5):580-587.
69. Boyd ST, Boyd LC, Zillich AJ. Medication therapy management survey of the prescription drug plans. *Journal of the American Pharmacists Association.* Nov-Dec 2006;46(6):692-699.
70. Moczygemba LR, Barner JC, Roberson K. Texas pharmacists' opinions about and plans for provision of medication therapy management services. *Journal of the American Pharmacists Association.* Jan-Feb 2008;48(1):38-45.
71. Ryan GJ, Chesnut R, Odegard PS, Dye JT, Jia H, Johnson JF. The impact of diabetes concentration programs on pharmacy graduates' provision of diabetes care services. *American Journal of Pharmaceutical Education.* Aug 10 2011;75(6):112.
72. Janke KK, Sorensen TD, Traynor AP. Instruction for student pharmacists on leading change. *American Journal of Pharmaceutical Education.* Apr 7 2009;73(2):30.
73. Urmie JM, Farris KB, Herbert KE. Pharmacy students' knowledge of the Medicare drug benefit and intention to provide Medicare medication therapy management services. *American Journal of Pharmaceutical Education.* Jun 15 2007;71(3):41.
74. Moczygemba LR. *The impact of pharmacist provision of medication therapy management (MTM) on medication and health-related problems, medication knowledge, and medication adherence among Medicare beneficiaries*, University of Texas Libraries; 2008.

75. Stevens J. *Applied multivariate statistics for the social sciences.* 5th ed. New York: Routledge; 2009.
76. Polit DF, Beck CT. *Nursing research: Generating and assessing evidence for nursing practice.* Lippincott Williams & Wilkins; 2007.
77. Campbell JC. Health consequences of intimate partner violence. *Lancet.* 2002;359(9314):1331-1336.
78. United States. Bureau of the Census. U,S. Census Bureau: State and County QuickFacts. 2011; http://quickfacts.census.gov/qfd/states/48000.html. Accessed December 4, 2011.
79. Health, United States, 2010: With Special Feature on Death and Dying. National Center for Health Statistics (US); 2011 http://www.cdc.gov/nchs/data/hus/hus10.pdf. Accessed December 5, 2012.
80. Sharma S, Malarcher AM, Giles WH, Myers G. Racial, ethnic and socioeconomic disparities in the clustering of cardiovascular disease risk factors. *Ethnicity and Disease.* 2004;14(1):43.
81. Cooper LA, Powe NR, Fund C. *Disparities in patient experiences, health care processes, and outcomes: the role of patient-provider racial, ethnic, and language concordance.* Commonwealth Fund; 2004.
82. Kirk JK, Bell RA, Bertoni AG, et al. A Qualitative Review of Studies of Diabetes Preventive Care Among Minority Patients in the United States, 1993-2003-Page 2. *American Journal of Managed Care.* 2005;11:349-360.
83. Barnes PM, Bloom B, Nahin RL. Complementary and alternative medicine use among adults and children: United States, 2007. US Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Health Statistics; 2008.
84. Eisenberg DM, Kessler RC, Van Rompay MI, et al. Perceptions about complementary therapies relative to conventional therapies among adults who use both: results from a national survey. *Annals of Internal Medicine.* Sep 4 2001;135(5):344-351.
85. Scott GN, Elmer GW. Update on natural product--drug interactions. *American Journal of Health-System Pharmacy.* Feb 15 2002;59(4):339-347.
86. Mojtabai R, Olfson M. Medication costs, adherence, and health outcomes among Medicare beneficiaries. *Health Affairs.* Jul-Aug 2003;22(4):220-229.
87. Seymour RM, Routledge PA. Important drug-drug interactions in the elderly. *Drugs and Aging.* Jun 1998;12(6):485-494.
88. Tamblyn RM, McLeod PJ, Abrahamowicz M, Laprise R. Do too many cooks spoil the broth? Multiple physician involvement in medical management of elderly patients and potentially inappropriate drug combinations. *CMAJ.* Apr 15 1996;154(8):1177-1184.

Vita

Ahmed Mohammed Alshehri was born in Riyadh, Saudi Arabia, on April 16, 1984, to Mohammed and Zainah Alshehri. In 2008, he earned his Bachelor's degree in pharmaceutical science from King Saud University College of Pharmacy in Riyadh, Saudi Arabia, after completing a four-month internship in King Fahad Medical City. Immediately after graduation, Ahmed began working as an in-patient pharmacist at King Abdulazizi Medical City National Guard Hospital. He worked in many pharmaceutical care settings, including the intravenous room and several satellite pharmacies, including intensive care, cardiac, pediatric, and long-term neonatal care. In December 2008, in addition to working as a pharmacist, he also worked as a teaching assistant in King Saud University College of Pharmacy, Alkarje, Saudi Arabia. In August 2009, he resigned from his position as a pharmacist in King Abdulaziz Medical City and came to the U.S. to pursue his Master's and PhD degrees. After studying intensive English at The University of Texas at Austin for one year, he started his Master's degree in August 2010 in the College of Pharmacy, Health Outcomes and Pharmacy Practice division. He also is a member of the Pharmacy Honor Society, Rho Chi.

Permanent address (or email): Ph_ahmad_ksa@yahoo.com

This thesis was typed by Ahmed M. Alshehri.